THE YUKON ECONOMIC, COHORT-SURVIVAL, AND ENERGY MODELS

- FINAL REPORT -

prepared for the

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& Intergovernmental Relations

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1. INTRODUCTION

The Yukon economy is small (approximately 23,000 people), isolated, and dependent upon three key industries: federal government, mining, and tourism. As of April 1, 1983, the Yukon's three major hard rock mining operations had all closed, either permanently or until metal prices rise high enough to induce their operators to resume production.[1/] The closure of these mines increases the relative dependence of the Yukon economy on tourism and especially on federal government spending. In 1981, the most recent year for which full-year employment data are available, the federal government directly provided about 13 percent of all jobs and supported in excess of 70 percent of the Territorial government budget, which, in turn, directly provided another 19.4 percent of all wage and salary jobs. When one counts jobs created by direct government construction spending and by purchase of goods and services, it is clear that job creation by the federal government and jobs created via its support of the Territorial government may have approached 50 percent of all jobs provided. The closure of the Yukon's three largest mining ventures raises this proportion even higher in the short run.

The annual frequency database upon which this model is built contains relatively few time series observations. At

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1/ Whitehorse Copper closed because of a physically depleted ore body; Cyprus Anvil and the United Keno Hill Mines because of depressed metal prices.

the most, the data have fifteen observations (1967 to 1981), while in some cases as few as five observations exist. Faced with this limitation, the model specification and estimation process was dominated by three questions: What to model? What functional form to use? How to maximize information content subject to the constraint on degrees of freedom? The choice of a regression method was not debated.

Methods of estimation appropriate to large samples have no particular claim to optimality in the face of the small sample problems beseting the Yukon model. The method used to estimate the equations discussed below was unabashed ordinary least squares, subject to imposed point constraints on certain parameters. In some cases missing datapoints were estimated prior to the application of ordinary least squares.

Ultimately, the professional credibility of any model rests on its completeness, the reasonableness of its estimated relationships, and its performance. Because of the smallness of the sample size, historical datapoints could not be reserved for purposes of model testing. In the short run, therefore, the professional credibility of NEWYEM (as the model discussed here has been titled), must rest on its completeness and the reasonableness of its estimated relationships.

In comparison with many regional economic models NEWYEM represents a step ahead in terms of its completeness, capturing, as it

does, both financial and nonfinancial determinants of economic growth. Although the employment and income sectors constitute the core of the model (a commonplace), employment is not determined solely by income but rather by a variety of variables pertinent to individual industries. On the assumption that the additional information imposed is on balance "good," the inclusion of a broader array of employment determinants in the employment equations improves NEWYEM's ability to measure accurately the multiplier effects of new economic stimuli.

The desire to enhance the realism and detail of the model is nowhere more apparent than in the sector determining the quantity of ore milled at Cyprus Anvil and United Keno Hill mines. For each year of the simulation period, the revenue derived per tonne of ore milled is determined as a function of projected metal prices and the composition of the ore bodies. If this amount falls short of an empirically estimated breakeven level, mine output is set equal to zero.

In truth, NEWYEM consists of three models, all of which can be linked into one grand system, given enough computer memory. The three are: (1) the economic model proper; (2) the cohort-survival population model; and (3) the sector-end use-fuel specific energy demand model. Documentation for all three models is contained in this report.

2. EMPLOYMENT

In conformance with the industry disaggregation scheme under which Yukon employment data are published in the quarterly Yukon Economic Review[1/] NEWYEM recognizes employment in the following industries: mining, forestry, construction, services, transportation, communications & utilities, federal government territorial government, local government, and "other." Mining industry employment is further disaggregated into Cyprus Anvil, United Keno Hill, placer mining, and exploration.

The category "services" includes retail trade and wholesale trade employment as well as employment in the usual service industries (hotels, medical services...).

Only the residual category "other" is treated as exogenous. Included in "other" is oil and gas industry employment associated with the Foothills gas pipeline and with oil and gas industry exploration operations in the Yukon.

The equations for employment in construction, services, transportation, territorial government, local government, and communications & utilities are part of the model's simultaneous block. As such they are driven by variables from the first recursive block of equations, by lagged employment, and by other endogenous variables from the simultaneous block of equations.

1/ Yukon Economic Review, Economic Research and Planning Branch, Yukon Department of Economic Development and Intergovernmental Relations.

MINING

The mining employment equations are part of the first recursive block of equations. In turn, mining employment is one determinant of Yukon disposable personal income. Total mining employment also appears in the model as a determinant of employment in transportation. The equations which make up the mining employment sector are the following.

(1) RMICAYK = (.024*PLEADNY + .0345*PZINCNY + .03216*
25.177*PSILVNY + .03216*.078*PGOLDNY)/
(XTRE*CPI/2.106)

(2) QMICAYK = 0 if RMICAYK $\leq$ 57 or if RESCAYK $\leq$ 0
2923 otherwise

(3) RESCAYK = RESCAYK(-1)-QMICAYK

(4) RMIUKYK = (.0278*PLEADNY + .0052*PZINCNY + .03216*740*
PSILVNY)/(XRTE*CPI/2.106)

(5) QMIUKYK = 0 if RMIUKYK $\leq$ 241 or if RESUKYK $\leq$ 0
84.56 otherwise

(6) RESUKYK = RESUKYK(-1)-QMICAYK

(7) RGPYK = 0 if -3000 + 122.5*PGOLDNY/(XRTE*CPI) $\leq$ 0
-3000 + 122.5*PGOLDNY/XRTE*CPI), otherwise

(8) GOLDPYK = 1.125*RGPYK

(9) JMETYK = (PGOLDNY/41.25 + PCOPNY/1134 + PLEADNY/304
+ PZINCNY/356 + PSILVNY/1.55)/(XRTE*CPI*5)

(10) EMICAYK = .1434*QMICAYK

(11) EMIUKYK = 3.286*QMIUKYK

(12) EMIPYK = .00849*GOLDPYK

(13) EMIXYK = 236.3 + 48.9*JMETYK(-1)

(10.8) (4.5)

R^{-2} = .993

DW = 2.74

FIT 1971-1981

t-statistics in parentheses

Mnemonics are defined in Appendix B.

Equations (1)-(6) and (10) and (11) determine employment at Cyprus Anvil and at the United Keno Hill mines as a function of metric tonnes of ore milled (QMI...), where the number of tonnes of ore milled is set at recent annual averages if real Canadian dollar metal prices are above estimated breakeven levels, or at zero if metal prices are too low or if estimated reserves have been exhausted.

Equations (7), (8), and (12) determine employment in placer mining as a function of the amount of placer gold produced (GOLDPYK), in turn a function of the real Canadian dollar price of gold. The intermediate variable (RGPYK), defined as royalties paid on placer gold produced, was introduced into the model solely as an historical proxy for actual production.

Finally, equations (9) and (13) determine employment in mining exploration as a function of a lagged unweighted index of the real Canadian dollar prices of gold, copper, lead, zinc, and silver (JMETYK, 1971=1.000).[1/]

1/ 1971 prices: Gold (41.25/troy ounce); Copper (1134/metric tonne); Lead (304/metric tonne); Zinc (356/metric tonne); Silver (1.55/troy ounce).

The variables RMICAYK and RMIUKYK are estimates of the real Canadian dollar revenue derived from the milling of one metric tonne of ore at Cyprus Anvil and at United Keno Hill Mines, respectively. Taking equation (1) apart we have the following components.

.024*PLEADNY - The New York price (U.S. dollar) per metric tonne of lead times 0.24 (Cyprus Anvil ore is 2.4 percent lead).

.0345*PZINCNY - The New York price (U.S. dollars per metric tonne of zinc times .0345 (Cyprus Anvil ore is 3.45 percent zinc).

.03216*25.177*PSILVNY - The New York price (U.S. dollars) per troy ounce of silver times two factors. (Cyprus Anvil ore contains 25.177 grams of silver per tonne. The factor .03216 converts grams to troy ounces).[1/]

.03216*.078*PGOLDNY - The New York price (U.S. dollars) per troy ounce of gold times two factors. (Cyprus Anvil ore contains .078 grams of gold per tonne. The factor .03216 converts grams to troy ounces.);

XRTE*CPI/2.106 - Converts current U.S. dollars to real (1980) Canadian dollars by dividing by the spot exchange rate and the Canadian consumer price index rebased to 1980.

1/ 1 gram = .03216 troy ounces.

Equation (3) defines revenue per tonne of ore milled at the United Keno Hill Mines in a parallel fashion. Information on the composition of ores and on the current level of reserves (RESCAYK and RESUKYK) was obtained from the Department of Indian and Northern Affairs.[1/]

For Cyprus Anvil and United Keno Hill breakeven revenue per metric tonne of ore milled equals $57 (CA), and $241 (UKH), in constant 1980 Canadian dollars. In the case of Cyprus Anvil, the $57 breakeven estimate is the mean revenue per tonne as defined by (1) for 1981 and 1982 ($65.28 and $48.62, respectively). United Keno Hill Mines breakeven revenue per tonne of ore milled is defined to equal mean 1979-1981 operating costs per tonne of ore milled (1980 dollars), where the cost data are those published in the 1982-1983 Canadian Mines Handbook (p. 328).[2/]

The employment equations for Cyprus Anvil and United Keno Hill and also for placer mining are fixed coefficient "input-output" type relations, with the numerical coefficients set at their respective 1978-1980 mean ratios of employment to output.

Equations (1) and (4) which define revenue per tonne of ore milled for Cyprus Anvil and United Keno Hill Mines deserve a special comment in that they presume (a) that the composition of the ore bodies will remain unchanged as reserves are depleted; and (b) that the revenue per tonne (1980 dollars) re-

1/ Yukon Geology and Exploration 1979-1980, and Yukon Mines and Mineral Activities, annual.
2/ Northern Miner Press, Ltd., (Toronto) 1982.

quired for breakeven is constant over time. In truth, neither of these presumptions is likely to be correct. As ore bodies are played out, reserve quality typically deteriorates.[1/] It also happens that, typically, the real cost of extracting and milling a tonne of ore rises as operations move into areas more difficult to work. The model makes no allowance for future increases in breakeven revenue per tonne, largely because reported reserves for both Cyprus Anvil and United Keno Hill are relatively small (11 years for Cyprus Anvil and 4 years for United Keno Hill, at recent extraction rates). Should these reserve estimates be increased (as they regularly have been for United Keno Hill), it would make sense to build increasing breakeven revenue into the model. Similarly, any new mine for which equations are added to the model ought to be modelled with increasing required breakeven revenue per tonne of ore milled.

The model's mining sector is completed by an identity which simply states that total mining employment is the sum of its parts

(14) EMIYK = EMICAYK + EMIUKYK + EMIPYK + EMIXYK

A description of the methods used to define historical mining employment by these categories is given in Appendix A.

Should one or more new mines open in the Yukon, other than Cyprus Anvil or United Keno Hill, the model user can either (a)

1/ Between 1971 and 1980, Cyprus Anvil's reported reserves went from 4.9 percent lead, 6.8 percent zinc and 34.3 grams of silver per metric tonne to 2.9 percent lead, 4.4 percent zinc, and 35 grams of silver per metric tonne. (DIAND) The quality of reported United Keno Hill reserves underwent a similar change.

add output and employment equations of the sort shown above for Cyprus Anvil and United Keno Hill and include the new employment variables in (14); or (b) add what is known in the econometrics trade as an "add-factor" to equation (14). An "add-factor" is simply an additional variable that, in this case would be set equal to estimated employment in the new mines.

CONSTRUCTION

Construction employment is expressed as a linear function of real government investment (IGYK/CPIYK) and the real value of residential and nonresidential building permits issued (VPRYK + VBPNRYK)/CPIYK.

(15) ECYK = 321 + .0068*(IGYK + VPRYK + VBPNRYK)/CPIYK

(2.8) (2.9)

R^{-2} = .99

DW = 1.29

FIT 1977-1981

t-statistics in parentheses

Estimation of this equation required prior estimation of the variable IGYK (government investment) for 1979, 1980, and 1981. This variable appears only in the Yukon Territorial Accounts and, as such, is available only through 1978. Further complicating matters was the fact that published data on Yukon construction employment were available only back to 1977. There were, therefore, only two years of overlap for the variables ECYK and IGYK, namely 1977 and 1978.

To solve this problem we first found the mean 1977, 1978 ratio of construction employment to the deflated composite right-hand-side variable shown above in equation (15). The 1977 value of this ratio was .0167, the 1978 value, .0111, and the mean .0139.

We then estimated IGYK for 1979, 1980, and 1981 by solving the following equation

ECYK = .0139*(IGYK + VPRYK +VBPNRYK)/CPIYK

using actual 1979, 1980, and 1981 values for all variables other than IGYK. The resultant estimated values of IGYK were (thousands of dollars);

1979 - 31568

1980 - 24007

1981 - 35802

As a check we noted that the published 1976, 1977, and 1978 values of IGYK were 30337, 37674 and 58663, respectively. Construction employment declined by 19.6 percent in 1979, and a further 20.8 percent in 1980.

Equation (15) was then estimated via ordinary least squares using the estimated 1979, 1980, and 1981 values of IGYK, and published data for the remaining variables and the 1977-1978 observations on IGYK.[1/] The resultant equation states that,

1/ The practice of substituting estimates for missing data is well established in the literature. In this case, the only alternative to the use of estimates for IGYK was to omit the variable entirely, a clear misspecification. On this subject one can see the review by Hartley, H.O. and Hocking, R.R., "The Analysis of Incomplete Data," Biometrics, December 1971, pp. 783-823, and the references cited therein.

on average, for every additional $1 million in real government investment or building permits issued, 6.8 year-round full-time equivalent construction jobs are created.

Because of the relative scarcity of data (only five observations covering the years 1977-1981), it was not reasonable to estimate separate coefficients for government investment, residential permits authorized, and nonresidential permits authorized, nor was it possible to account for the fact that some construction projects take more than one year to complete. At least in the case of government investment, however, the latter problem is ameliorated by the fact that IGYK gives actual expenditures. In this case, multi-year government projects show up as government expenditure in two or more years.

SERVICE INDUSTRIES

Service industries are usefully thought of as lying in the "support" sector of the economy to the extent sales by service industries are restricted to Yukon Territory residents and government agencies. Because some retail sales and sales of services proper are to nonresidents (tourists, be they on business or pleasure trips), it is important to account for the effect of tourist expenditure on job creation.

(16) ESVYK = -657.8 + .0116*(YDYK + GFOCYK + GLOCYK + GTOCYK + LGFPYK + LGFBYK + LGTPYK)/CPIYK + .0151*TOURXYK/CPIYK

As in the case of the construction employment equation, the unavailability of Territorial Accounts data after 1978 dictated a departure from straight-forward regression analysis. In this case, 1979-1981 estimates of disposable personal income were constructed, (see Appendix A), and the equation originally estimated over the period 1972-1981 excluding the government spending and lending variables (GFOCYK +...+ LGTPYK).[1/] Because we could not estimate with adequate confidence, all of the missing government spending and lending variables for 1979, 1980, and 1981, and secondly, because we were unwilling to either omit them from the equation or truncate the sample, the spending-lending variables were added after the fact. In particular, the first right-hand-side variable was redefined to equal that shown in (16) and its coefficient suitably altered. The alteration to the slope coefficient consisted of dividing the original slope coefficient by 1.4691, the mean 1972-1978 ratio of (YDYK + GFOCYK +...+ LGTPYK) to YDYK.

The "actual" values of ESVYK, the fitted values from the original regression which excluded the government spending-lending variables, and the values estimated from (16) over the period 1972-1978 are given in the text table.

1/ The original equation was

$$\underset{}{ESVYK} = \underset{(-.5)}{-657.8} + \underset{(3.3)}{.017}*YDYK/CPIYK + \underset{(0.5)}{.0151}*TOURXYK/CPIYK$$

$\underset{-2}{}$

R = .98
DW = .88
FIT 1972-1981
t-statistics in parentheses

	ACTUAL	ORIGINAL EQUATION	EQUATION (16)
1972	1940	1481	1406
1973	1730	1596	1629
1974	1548	2009	2263
1975	1710	2001	2068
1976	1852	1906	1950
1977	1885	2161	1902
1978	2081	2194	1972
MEAN	1821	1907	1885

Equation (16) imposes the assumption that a dollar of real government spending and lending has the same job creation effect as roughly 70¢ to 85¢ of consumer spending. (The estimated Yukon average propensity to consume out of disposable personal income lies in the range .70 to .85.) The resultant equation, states that every extra million dollars of real government spending or lending or every extra million dollars of real Yukon disposable income, creates approximately 12 service industry jobs. The estimated impact of real tourist expenditure is somewhat larger. Every extra million dollars of real tourist expenditure creates approximately 15 service industry jobs.[1/]

TRANSPORTATION

The equation determining employment in transportation was initially estimated via straight-forward ordinary least squares, and expressed employment as a function of real disposable per-

1/ All dollar magnitudes are in thousands. To get the marginal job creation associated with $1 million in extra spending, multiply the respective slope coefficients by 1000.

sonal income and employment in mining.

(17A) ETYK = 172.3 + .0016*YDYK/CPIYK + .2213*EMIYK

(2.1) (4.2) (2.9)

(PRELIMINARY VERSION) R^{-2} = .999

DW = 2.22

FIT 1972-1981

t-statistics in parentheses

According to this equation, approximately 16 year-round full-time equivalent jobs are created for every extra $10 million in real Yukon disposable personal income. For every extra 100 jobs in mining, approximately 22 jobs are created in transportation. In 1981 there were 798 jobs in transportation and 1532 jobs in mining. Thus, the equation (17A) states that 339 of the 798 transportation jobs (42.4 percent) were attributable to mining activity.

In a version of this equation which we have chosen not to use, the absolute value of the change in Yukon population was added to the specification in (17A). Virtually no change occured in the estimated coefficients on income or mining employment. The fit was, however, marginally improved, with the estimated coefficient on population change indicating that for every 1000 person change (plus or minus) in population, 7 jobs were created in transportation. This term was intended to capture the effect of movement to and from the Yukon. A more theoretically preferred specification was also tried, substitution of net migration for population change. The result was disappointing, in that the absolute value of net migration showed up with a negative coefficient. The problem undoubtedly stemmed from the

fact that the very small database placed severe restrictions on the number of right-hand-side variables that can be included in a standard linear regression.

Because population change should be included as a determinant of transportation employment, the final specification, equation (17B), was selected. To estimate this equation, the left-hand-side variable was defined to equal ETYK -.007*ABS(NMIGYK).[1/] That is, a coefficient of .007 was imposed on net migration and then the remaining parameters were estimated via ordinary least squares. The coefficient .007 is that estimated on population change in an amended version of (17A). The final equation then became:

(17B) ETYK = 174.0 + .00164*YDYK/CPIYK
(2.0) (4.3)
+ .2133*EMIYK + .007*ABS(NMIGYK)
(2.7)

R^{-2} = .999

DW = 2.27

FIT 1972-1981

t-statistics in parentheses

The final version of this equation, (17B), states that:

(a) for every additional $10 million in real disposable personal income 16 jobs are created in transportation;
(b) for every 100 extra mining jobs, 22 jobs are created in transportation; and
(c) for every 1000 persons migrating to or from the Yukon, 7 jobs are created in transportation.

1/ "ABS" denotes the absolute value.

COMMUNICATIONS AND UTILITIES

This employment equation is acceptable but nonetheless lacking, in that it proved impossible to specify and estimate an equation that contained a realistic real per capita income term and a believable population term. Communications is an expanding industry in North America (cable t.v., computer networking, etc.). Recently, expanded satellite television programming has come to the Yukon. It seems likely that further expansion of the communications industry will take place where and when both population growth and real income growth (on a per capita or per household basis) justifies it. For this reason, it would be preferable to have both effects in this equation. Attempts to do so, however, invariably resulted in either the income variable or the population variable taking an unacceptably high coefficient (implied partial elasticities of employment with respect to one or the other of greater than or equal to 2.0).

(18) ECUYK = 590.6 + .0357*NYK + .4228*ECUYK(-1)

(-2.9) (3.1) (1.8)

$\bar{R}^2$ = .992

DW = 2.04

FIT 1972-1981

t-statistics in parentheses

The partial elasticity of employment with respect to population measured in 1981, is 1.80. This may still be somewhat high. However, the linear form of (18) at least has the feature that

this partial elasticity will decline toward 1.0 over the forecast period if population grows.[1/] In the future as more and better data become available, it might pay to respecify this equation.

GOVERNMENT EMPLOYMENT

In this model, government employment is determined by the size of government payrolls and by the size of the average annual paycheck per job. The equations, one for each level of government, are identies.

(19) EGFEDYK = WGFEDYK/AEGFYK (federal)

(20) EGLYK = WGLYK/AEGLYK (local)

(21) EGTYK = WGTYK/AEGTYK (territorial)

Total payrolls (W...YK) are determined in the government spending sector of NEWYEM as an exogenously set fraction of budget constrained operating expenditure. The chain of causality established here is premised on the assumption that government decisions to hire more or fewer public employees are largely supply-of-funds determined; and that personnel requirements can be satisfied either by hiring more workers, or by contracting with the private sector, or by cutting back on other categories of spending.

1/ The partial elasticity = (∂ECUYK/∂NYK)*(NYK/ECUYK), where ∂ECUYK/∂NYK = .0357. Because this elasticity is initially greater than 1.0, the ratio NYK/ECUYK will decline over the forecast period, if population is growing.

FORESTRY

Forestry employment is determined in NEWYEM as a simple "input-output" function of annual primary forest production. Since 1977, the earliest year for which lumber employment data are published, the job count has ranged from a low of 26 jobs (1977) to a high of 52 jobs (1980). The small size of the industry (even by Yukon standards) and the lack of data dictated the approach taken.

The equation is

(22) ELUMYK = .316*TIMYK

where the coefficient is the mean 1977-1981 ratio of employment to primary production. Using this equation to estimate historical employment yields the following comparison.

	ACTUAL EMPLOYMENT	.316*TIMYK
1977	26	24
1978	28	37
1979	31	36
1980	52	50
1981	27	17
MEAN	33	33

Were (22) the result of a regression with a zero intercept the R^2 would be 0.67, since the simple correlation coefficient between actual and estimated employment is 0.82.

3. INCOME AND CONSUMPTION

This sector includes equations for

- Annual pay per job for mining, construction, services transportation-communications-utilities, federal government, territorial government, and local government; (AE...YK)
- total annual payrolls for mining, construction, services, transportation-communications-utilities, federal government, territorial government, and local government; (W...YK)
- total Yukon wage and salary payments (WSYK);
- income of unincorporated enterprises (YUNYK):
- personal investment income (YINVYK);
- payrolls for active duty military (YMILYK);
- imputed value of traditional activities (YTRADYK);
- transfer payments from businesses to persons and unincorporated enterprises (VBPYK);
- total transfer payments to persons and unincorporated enterprises (VBPYK);
- federal collections of direct taxes on persons and unincorporated enterprises (RFPITYK);
- disposable personal income (YDYK);
- total personal income (YPYK);
- consumption expenditure on durable goods (CDYK);
- consumption expenditure on other than durable goods (CNDYK); and
- total consumption expenditure (CYK).

ANNUAL PAYROLL PER JOB, BY INDUSTRY

Neoclassical economic theory tells us that real wages per person-hour are a supply-demand determined function of employment, and that, on average, the real hourly wage rate rises at the rate of growth of labor's marginal productivity. Alternative theories such as those associated with the name of Gardiner Means assert that wages are an administered price, the precise level of which is in part a function of tradition and in part a function of the relative bargaining power of labor and management.[1/] Arthur Okun believed that some labor markets were competitive and some administered.[2/]

In this model, payroll per job (equal to average annual hours worked times the hourly wage rate) is allowed to track inflation in an historical pattern. In the absence of information on the temporal pattern of working hours, this formulation, while not elegant, at least holds the promise of not getting too far off the track in a long run simulation. The equations are:

(23) AETCUYK = -.136 + 15.268*CPIYK

(-1.6) (1.7)

$\bar{R}^2$ = .91

DW = 1.46

FIT 1972-1978

t-statistics in parentheses

1/ For a summary of Mean's work see "The Administrative Economics of Gardiner C. Means," chapter 7 in Gruchy, A.G. Modern Economic Thought, (Augustus Kelley Publishers, New York), 1967.

2/ Okun, Arthur, Prices and Quantities: A Macroeconomic Analysis, (Brookings Institute, Washington, D.C.), 1981.

(24) AESVYK = -.6105 + 9.69*CPIYK

(-.39) (5.7)

$\bar{R}^2$ = .99

DW = 1.54

FIT = 1972-1978

t-statistics in parentheses

(25) AECYK = -50.28 + 77.9*CPIYK

(-4.9) (7.1)

$\bar{R}^2$ = .96

SW = 2.45

FIT 1972-1978

t-statistics in parentheses

(26) AEMIYK = .454 + 18.1528*CPIYK

(.31) (10.3)

$\bar{R}^2$ = .99

DW = 2.53

FIT 1969-1978

t-statistics in parentheses

(27) AEGTYK = 3.822 + 8.7716*CPIYK

(6.2) (16.8)

$\bar{R}^2$ = .99

DW = 1.18

FIT 1972-1981

t-statistics in parentheses

(28) AEGLYK = 1.1014 + 12.4229*CPIYK

(2.0) (25.8)

$\bar{R}^2$ = .99

DW = 1.77

FIT 1972-1981

t-statistics in parentheses

(29) AEGFYK = -2.3022 + 9.4293*CPI

(-3.6) (24.6)

$\bar{R}^2$ = .99

DW = 2.74

FIT 1972-1981

t-statistics in parentheses

Periods of fit were determined by the availability of payroll data and employment data. Those fit 1972 to 1978 (transportation-communications-utilities, services, and construction) had payroll data available 1967 to 1978 but employment data only back to 1972.[1/] For the mining industry, payrolls were available 1967-1978, but employment only back to 1969. The government employment data were available back to 1972, and the payroll data 1967 to 1981.

1/ The historical values of the left-hand side variables are defined to equal payrolls divided by employment.

TOTAL ANNUAL PAYROLL, BY INDUSTRY

A series of seven identities determines these variables by industry.

(30) WMIYK = AEMIYK*EMIYK

(31) WCYK = AECYK*ECYK

(32) WTCUYK = AETCUYK*(ETYK + ECUYK)

(33) WSVYK = AESVYK*ESVYK

(See the section entitled "GOVERNMENT" for the government payroll equations.)

TOTAL WAGE & SALARY PAYMENTS, ALL INDUSTRIES

This equation expresses total wage and salary payments as a function of payrolls by industry.

(34) WSYK = EXP(.0327*LOG((EOYK + ELUMYK)*CPIYK) + .5472
(1.4)
+ .9482*LOG(WMIYK + WCYK + WTCUYK + WSVYK +
(28.0)
WGFEDYK + WGTYK + WGLYK)

$\bar{R}^2$ = .99

DW = 2.16

FIT 1972-1978

t-statistics in parentheses

The variable WSYK, total Yukon civilian wage and salary payments, was obtained historically from the Territorial Accounts. As such it was not available past 1978. Data for EOYK and ELUMYK were not available prior to 1972.

This equation together with the equations determining industry payrolls is a key linkage in the simultaneous block of the model. Because payroll data were not available for the forestry industry and for the miscellaneous category "other," the first term in (34) incorporates the product of the Yukon consumer price index and employment in these industries as a proxy for payrolls. Were it not for this approximation, one would expect the two estimated slope coefficients (partial elasticities) to sum to unity. As it is, they sum to .9809 (.0327 + .9482 = .9809).

The coefficient on the proxy variable, .0327, was imposed and only the remaining two coefficients estimated via the least squares method. The imposed coefficient was set equal to the 1981 ratio of (a) employment in forestry and "other" to (b) total employment. Attempts to directly estimate the coefficient on the proxy variable yielded negative numbers on that coefficient and an inappropriately high (1.25+) estimated partial elasticity of WSYK with respect to the second term, LOG(WMIYK,...).

INCOME OF UNINCORPORATED ENTERPRISES

The product of the number of self-employed persons and the Yukon consumer price index acting as a first-pass proxy variable

for income was related to the historical income variable via ordinary least squares.

(35) YUNYK = 973.88 + 4.528*NSEYK*CPIYK
(1.4) (4.8)

$\bar{R}^2$ = .99
DW = 0.97
FIT 1972-1978
t-statistics in parentheses

At the margin, each new self-employed person is estimated to earn $4528 (1976 dollars), or $8255 in 1981 dollars. The part-time or seasonal nature of much self-employment may account for the seemingly small size of these estimates.

PERSONAL INVESTMENT INCOME

Stock market performance, interest rates, bank deposits, and population determine personal investment income in NEWYEM.

(36) YINVYK = NYK*EXP(-10.4072 + .83*LOG(JSTOCK*JDIVT)
(-2.6) (1.5)
+ .3678*LOG(RTBIL*BDEPYK))
(2.6)

$\bar{R}^2$ = .99
DW = 1.12
FIT 1967-1978
t-statistics in parentheses

Stock market performance is measured by the log of the product of the Toronto Stock Exchange closing index and the Toronto Stock Exchange average dividend yield. The product of the Canadian Government 90-day treasury bill rate and bank deposits acts as a proxy for sources of interest income. For every ten percent increase in the stock index or the yield on stocks, investment income rises 8.3 percent. For every 10 percent increase in the treasury bill rate or in bank deposits, investment income rises 3.7 percent. (In both cases, all other things equal.)

PAYROLLS FOR ACTIVE DUTY MILITARY

According to the Whitehorse military detachment, there are only six full-time military personnel on duty in the Yukon. This situation has been static since the late 1960's. Given the small size of this component, it seemed best to assume that future gains in military pay will keep pace with inflation, and that real, per military-person pay will remain constant. Should it be necessary to simulate a large buildup, this equation will at least give reasonable projections of total military income.

(37) YMILYK = (NMILYK/NMILYK(-1))*YMILYK(-1)*
CPIYK/CPIYK(-1)

IMPUTED VALUE OF TRADITIONAL ACTIVITIES

This equation is included for completeness. Because it was not possible to do a serious analysis of the determinants of tradi-

tional activity, the model projects future values to grow only at the rate of consumer price inflation.

(38) YTRADYK = (CPIYK/CPIYK(-1))*YTRADYK(-1)

TRANSFER PAYMENTS TO PERSONS

Transfer payments to persons are the sum of payments received from business, the federal government, the territorial government, and local governments. Transfer payments to Yukon residents from persons living outside the Yukon are not included in the Territorial Accounts definition of transfer payments to persons (Yukon residents). The equations are:

(39) VBPYK = -56.7 + .00196*(WSYK-WGFEDYK-WGTYK-WGLYK)
(-2.4) (3.4)
-.068*RTBIL*VBPYK(-1)
(-1.3)

$\bar{R}^2$ = .90

DW = 2.04

FIT 1968-1978

t-statistics in parentheses

(40) VPYK = VBPYK + VGFPYK + VGTPYK + VGLPYK

(NOTE: The equations for government transfers to persons are shown in the section of this report entitled "GOVERNMENT.")

Business transfers to persons are defined as a function of wages and salaries paid by business on the assumption that such transfers rise either as employment increases or as paychecks grow. The inclusion of an interest rate effect was hypothesized on the grounds that business may delay paying certain transfer payments if interest rates rise. (Seek to earn the interest.)

For every $1 million increase in private sector payrolls, business transfer payments to persons rise $1,960. If the Canadian Treasury 90-day bill rate increases one percentage point for one year, business transfers to persons are reduced by 6.8 percent of their previous year's level. The product of the bill rate and the previous year's transfers allows the dollar amount of the interest rate effect to vary as the size of total payments varies.

FEDERAL DIRECT TAXES ON PERSONAL INCOME

Data on this series for the Yukon are available only through 1978. However, for Canada as a whole, the series extends through 1981. The text table shows the behavior of federal direct taxes as a percent of personal income for the years 1971-1981. (This period was chosen because it was felt that

recent experience may be more indicative of governmental attitudes concerning the "appropriate" level of direct taxation.)

	(A) PERSONAL INCOME TAX DIVIDED BY PERSONAL INCOME (CANADA)	(B) FEDERAL DIRECT TAXES DIVIDED BY PERSONAL INCOME (YUKON)	(B) ÷ (A)
1971	.1369	.1694	1.237
1972	.1359	.1570	1.155
1973	.1358	.1665	1.226
1974	.1382	.1742	1.260
1975	.1323	.1621	1.225
1976	.1355	.1498	1.106
1977	.1381	.1548	1.212
1978	.1296	.1524	1.176
1979	.1303	NA	
1980	.1340	NA	
1981	.1400	NA	

NOTE: (A) equals CANSIM series D30136 divided by CANSIM series D30315.

The mean all-Canada average tax rate 1971-1981 was .1351. The mean 1971-1978 ratio of the Yukon tax rate to the all-Canada rate was 1.188.[1/] The model projects Yukon direct federal tax collections to equal the product of these two means (.1605) times Yukon personal income.

1/ The higher Yukon rate reflects higher Yukon nominal incomes and a progressive rate structure.

(41) RFPITYK = .1605*YPYK

In effect, the model projects that periodic federal tax reductions or explicit indexation will offset bracket creep and prevent the effective tax rate from trending upwards over the long term. Were the purpose of this model to forecast short run changes in income tax collections a different approach would be adopted, one which takes explicit account of income distribution and statutory tax rates, brackets, exemptions, and deductions.[1/] For long term policy analysis, such detail is not likely to be worth the cost of the added complexity.

TOTAL PERSONAL INCOME

The equation is simply an identity.

(42) YPYK = WSYK + YUNYK + YINVYK + YTRADYK + YMILYK + VPYK

DISPOSABLE PERSONAL INCOME

Again, an identity.

(43) YDYK = YPYK RFPITYK VPTYK

Disposable income equals personal income less federal direct tax collections, less transfer payments from persons to the

1/ See Reaume, D.M., "Forecasting State Income Tax Collections: A New Approach," Public Finance Quarterly, January 1978, pp. 67-92.

territorial government. (Personal transfers to other governments are not accounted for in the Territorial Accounts.)

(44) VPTYK = .219*NYK*CPIYK - .0855*DUM6771

(7.1) (-1.8)

$\bar{R}^2$ = .98

DW = .95

FIT 1967-1978

t-statistics in parentheses

Personal transfer payments to the territorial government are proportional to the product of population and the consumer price index. The dummy variable, DUM6771, was defined as 1.0 for the years 1967-1971, and Ø otherwise. It does not appear in the forecasting model.

CONSUMPTION

The Yukon Territorial Accounts data series for consumption, when taken together with the series for disposable personal income implies personal savings rates in excess of 40 percent for the Yukon. These are quite high by Canadian national standards. For example, between 1975 and 1978, the national savings rate averaged only 12.1 percent. The Yukon Territorial Accounts average Yukon savings rate for the same period was approximately 41 percent. Because the Yukon consumption series is not survey based, there is some question as to its accuracy, especially in

light of the very high implied savings rates. The income series, on the other hand, should be relatively accurate, since it can be benchmarked to payroll records and federal tax returns. Because of these difficulties we have (a) excluded consumption from the simultaneous block of the model; and (b) have re-estimated the historical series based on a behavioral relation fit to national data.

The equations fit to national data are:

(45) CND = YD*(.8047 - .0037*RTBIL - .19*CPI/CPI(-1))
(18.0) (-1.2) (-1.0)

$\bar{R}^2$ = .99
DW = 0.63
FIT 1968-1981
t-statistics in parentheses

(46) CD = YD*EXP(-1.4786 + .25*LOG(BDEP/(N*CPI))
(-5.3)
-.45*LOG(YD/(CPI*N)) - .0047*(RTBIL + 100
(-1.6) (-.9)
- 100*CPI/CPI(-1)))

$\bar{R}^2$ = .99
DW = .95
FIT 1968-1981
t-statistics in parentheses

For the years 1968 to 1978, estimated Yukon service and non-durable good consumption (CNDYK), durable good consumption expenditure (CDYK), and total consumption expenditure (CYK) are given below. These estimates were made by solving (45) and (46) with Yukon data, adjusted for differences in units of measurement. Equations (45) and (46) (for Yukon data) have been included in the model, even though estimated consumption is not used as an explanatory variable in any other equations. The equations are part of the second recursive block. As such they are driven by but do not drive other equations.

CONSUMPTION [1/]

(Thousands of Current Dollars)

	CNDYK	CDYK	CYK	YUKON ACCOUNTS
1968	20655	4808	25463	26581
1969	23069	5395	28464	29529
1970	28476	6510	34986	35432
1971	31871	7219	39090	37071
1972	37229	8495	45724	37769
1973	41870	9786	51656	43488
1974	51997	11328	63325	52409
1975	63100	16239	79339	64997
1976	73888	16999	90887	82976
1977	87831	20114	107945	90653
1978	96037	22217	118254	97275

1/ As estimated by equations (45) and (46) supplied with Yukon data, on the one hand, and in the Territorial Accounts, on the other.

The average propensity to save defined as 1-CYK/YDYK, ranges from a low of .271 in 1971 to a high of .327 in 1975. The mean for the years 1975 to 1978 is .310, a figure approximately 20.0 percent lower than that implicit in the Territorial Accounts.

4. POPULATION, LABOR FORCE

The population sector of NEWYEM is supplemented by a separate cohort-survival model that produces estimates of the Yukon population by age (five year intervals), race (Native, non-Native), and sex. For many purposes it should not be necessary to solve the cohort-survival model once the birth and death equations in NEWYEM have been calibrated. (See Chapter 8, below.)

The population equations in NEWYEM are as follows.

(47) NYK = NYK(-1) + NMIGYK + BYK - DYK

(48) BYK = .0192*NYK

(49) DYK = .0038*NYK

(50) NMIGYK = -500 + .535*(ETOTYK-ETOTYK(-1))
+ 536.49*ETOTYK(-1)/NYK(-1) + .0002*
$(ETOTYK-ETOTYK(-1))^2$ +.0022*ETOTYK(-1)

Equation (47) is the usual population identity, while (48) and (49) set births snd deaths, respectively, equal to the 1981 Census ratios of births and death to population, times population.

The coefficients in (48) and (49) can be calibrated to a particular forecast scenario after first solving the cohort-survival model. (The latter applies birth rates only to women of child-bearing age and allows the death rate to vary by age.)

The key population equation is that for net civilian migration, equation (50). It embodies the assumption that the percent of new Yukon jobs filled by migrants is an increasing function of the number of new jobs created. Migration of dependents is implicitly accounted for in the equation's coefficients. For example, if 100 new jobs are created 53.5 persons (new migrant job getters plus dependents) come to the Yukon. If 1000 new jobs are created 555 persons come to the Yukon. (Not 535 as would be the case if the quadratic term were zero.) Because spouses of new migrants may obtain jobs in subsequent years, and because in subsequent years these spouses are treated as residents, the total number of new jobs eventually going to migrants or their spouses may be somewhat larger than indicated by the equation.

The equation further states that for every one percentage point increase in the ratio of employment to population, net migration rises by 5.36 persons. (The higher this ratio, the fewer unemployed Yukon residents, hence the greater the need to hire migrants into new jobs. In 1981 the ratio of total employment

to population equaled 0.426. This figure is an outlier. Between 1978 and 1981 the ratio of employment to population ranged between .362 and .389.

As it was originally fit, equation (50) fit well but was unacceptable for forecasting purposes. The original version of (50) was (50A):

(50A) NMIGYK = -18830.8 + .535*(ETOTYK-ETOTYK(-1)) +
(-3.7) (2.2)
53649*ETOTYK(-1)/NYK(-1) + .00002*(ETOTYK-
$ETOTYK(-1))^2$ - .157*ETOTYK(-1)
(-2.1)

R^{-2} = .72

DW = 2.56

FIT 1968-1981

t-statistics in parentheses

When the model was simulated, relatively small reductions in the ratio of lagged employment to lagged population quickly became cumulative given the large negative intercept in (50A). To solve this problem, the intercept was set equal to -500 and the coefficient on the employment-population ratio multiplied by .01. Then using 1981 data (the most recent year for which all series were available), equation (50A) was solved for the implied coefficient on the last term, ETOTYK(-1). The sign change between (50A) and (50) on lagged employment was maintained since theory cannot distinguish between a negative and a positive sign on this variable. The positive sign

suggests that increasing employment has a lagged positive effect on net migration. (JOBS! COME AND GET 'EM!)

Over the 1968 to 1981 period of fit, the largest single year's net migration was 989 persons (in 1971). This is not surprising since there is nothing in the post-1967 Yukon experience that approximates a very large boom, if by very large we mean job creation in excess of 25 percent of the previous year's employment total. Should such a boom need to be analyzed by the model, it may be necessary to judgementally adjust the net migration equation to account for boom-period migration in excess of that projected via the equation's quadratic term.

The civilian labor force equations in NEWYEM are:

(51) LCYK = NYK*(-.3876 + LCYK(-1)/NYK(-1) +.3876*ETOTYK/ETOTYK(-1)
(-2.0) (+2.0)

$\bar{R}^2$ = .99

DW = 1.57

FIT 1974-1981

t-statistics in parentheses

(52) RUYK = RUYK(-1)*(1 + LCYK/LCYK(-1) - ETOTYK/ETOTYK(-1))

(53) UYK = (RUYK/100)*LCYK

(54) NSEYK = LCYK - UYK - ETOTYK

Equations (52), (53), and (54) are identities. In (52) the unemployment rate is projected to change in percentage terms at the difference between the rate of change of the labor force and the rate of change of total wage and salary employment. Were the equation to use the same definition of employment as that used in the official labor force - employment statistics, this equation would be exact.[1/] This substitution has been made because past experience has shown that well-behaved projections of the labor force-employment variables are best obtained in this manner. The key problem is that good behavioral projections of the difference between the measured labor force and the measured number of unemployed, turn on the availability of data on self-employment and moonlighting (taking of a second job), data which are available only from small sample surveys. Equation (52) assures that the projected unemployment rate will behave in a reasonable manner.

Equation (53) defines the number of unemployed persons in the usual manner.

1/ The unemployment rate is defined to equal the ratio of the number of unemployed to the labor force. That is,

$$RUYK \equiv (UYK/LCYK)*100$$

But the number of unemployed (UYK) is defined to equal the labor force (LCYK) minus employment inclusive of proprietors, but exclusive of second jobs (EYK). With very little algebra we have

$$EYK = LCYK - UYK$$

where EYK can be thought of as the number of employed persons.

Equation (54) develops a proxy for the number of self-employed persons (NSEYK). In truth NSEYK differs from the number of self-employed by the extent to which jobs counted in ETOTYK are held by fewer than ETOTYK persons (some people hold more than one job), and by other definitional differences. However, NSEYK should be highly correllated with the true (unobserved) number of self-employed persons. The variable NSEYK is used only in determining proprietors income (YUNYK). As such it is a suitable proxy for self-employment.

The labor force equation, (51), although estimated from limited data, captures the important determinants of labor force behavior: population growth (NYK), recent experience (LCYK(-1)/NYK)-1)) and employment growth (ETOTYK/ETOTYK(-1)). The equation was estimated with the labor force participation rate (LCYK/NYK) as the left-hand side variable.

The original fitted values of the intercept term and estimated slope coefficient on the employment ratio were -.3953 and +.3799, respectively. For purposes of long run policy simulation it seemed best to equate the absolute values of these two coefficients to the mean of their absolute values. The resultant mean .3876 was then assigned in place of the coefficient previously fitted. The changes are less than 1/20th of an estimated standard error and assure that the labor force participation rate will grow if employment grows, and decline if employment declines.

5. HOUSING/BANK DEPOSITS

The following equations make up this sector.

(55) BDEPYK = (NYK*CPI/1000)*EXP(-1.646 + 1.38*LOG(YDYK/
(-12.6) (12.7)
(NYK*CPI)) + .523*(RTBIL/100 - CPI/CPI(-1) + 1))
(1.5)

$\bar{R}^2$ = .92

DW = 0.93

FIT 1968-1981

t-statistics in parentheses

(56) HCOMPYK = (NYK - NYK(-1))*(3.171 + .9342*(1000*BDEPYK/
(5.2) (3.4)
NCPI*NYK)) - 1.38*LOG(RMORT))
(-4.1)

$\bar{R}^2$ = .98

DW = 1.89

FIT 1968-1981

t-statistics in parentheses

(57) HHYK = .94*HHYK(-1) + HCOMPYK

(58) HADYK = .1572*HHYK

(59) HSAYK = HHYK*(.1263 + .0024*(TIME-15))

(60) HSDYK = HHYK*(.5842 - .0081*(TIME-15))

(61) HOYK = HHYK - HADYK - HSAYK - HSDYK

(62) VPRYK = (CPIYK/1.570)*(HADYK - HADYK (-1) + HSAYK -
HSAYK(-1) + HOYK - HOYK(-1))*15.724 + (HSDYK -
HSDYK(-1))*70.5

The equation for bank deposits (BDEPYK) was fit in real per capita terms to national data and then solved over the historical period using Yukon population (NYK) and disposable income (YDYK). Division of NYK*CPI by 1000 adjusts for units differences between the national population series and the Yukon series. (Unit differences cancelled in the per capita income variable.) The real treasury bill rate (RTBIL) acts as a proxy for interest rates on time deposits.

Estimated Yukon bank deposits for the years 1968 to 1978 are (millions of dollars):

YEAR	BDEPYK
1968	9.99
1969	11.31
1970	14.36
1971	15.58
1972	18.53
1973	21.37
1974	29.79
1975	35.43
1976	43.13
1977	50.91
1978	56.66

For 1981 and 1982 published personal bank deposit data for the Yukon and Northwest Territories (CANSIM series B5529) show $147.0 million and $167.5 million, for the two years, respectively.

Trial projections through 1981 of equation (55) show BDEPYK becoming large with respect to these published figures adjusted for relative Yukon-Northwest Territory population. At first this was troubling. However, upon further consideration it is clear that (55) estimates total deposits held by Yukon residents, wherever they are held. Almost certainly Yukon residents hold deposits elsewhere in Canada. Furthermore if one accepts BDEPYK as just an intermediate variable linking income, population size and interest rates to the variables driven by BDEPYK (CDYK, HCOMPYK, YINVYK), it is clear that even if BDEPYK does not actually measure Yukon bank deposit holdings of Yukon residents, it is a useful variable to have in the model. Use of BDEPYK in the equations for CDYK, HCOMPYK, AND YINVYK; (a) conserves degrees of freedom relative to the alternative of including the determinants of BDEPYK explicitly in these equations; and (b) appears to work well.

Housing completions (HCOMPYK) are also projected by an equation which was fit to national data. Equation (56) states that housing completions, as a proportion of population increases, are a function of real per capita bank deposits and nominal mortgage interest rates (RMORT).[1/] The left-hand-side variable of the regression was the ratio of housing completions to population change. Multiplication of bank deposits in (56) by 1000 is a units adjustment.

As it happens, over the 1968-1981 period of fit, there were no periods in which national population change was negative. Should

1/ Nominal mortgage rates, rather than real mortgage rates, were used because income qualification depends on the nominal monthly mortgage payment.

a Yukon simulation be formulated in which population change is negative for one or more periods, it will be necessary to add-factor (56) in order to prevent the nonsensical result of negative housing completions. In such an instance, the model user should follow an iterative procedure; first solving the model, then adjusting the add-factor in (56); then solving again. This procedure is made necessary by the fact that the Time Series Processor program (TSP) does not allow conditional statements (IF A THEN B ELSE C) within a simultaneous block of equations.

Equation (56) was written as shown above and solved over the 1969-1981 period as a check on its performance. The results were

YEAR	HCOMPYK
1969	875
1970	881
1971	1405
1972	1190
1973	1029
1974	0
1975	808
1976	514
1977	1477
1978	215
1979	656
1980	91
1981	575

Equation (57) states that the number of housing units (housing stock) deteriorates by 6.0 percent each year but rises by HCOMPYK. The 6.0 percent implied rate of deterioration of the stock was the rate which allowed (57) to track the 1971 to 1981 reported (Census) number of occupied housing units. Data on total housing units for the Yukon were not available. Applying equation (57) to the 1971 starting stock of 5096 units, yields a 1981 estimate of 7560 units, or approximately the 7600 units reported in the 1981 Census.

By identifying occupied housing units with total housing units, the model implicitly assumes a constant number of vacancies, or in a growing economy, a declining vacancy rate. This is an unavoidable assumption given the absence of vacancy data for owner occupied housing units.

A point of note is that the historical survival percentage in (57), .94, need not be held constant. The user can either change it for simulation purposes, or introduce a variable survival percentage. Indeed, one would not expect the historical value to be applicable in the long run, since it carries the implication that 79 percent of all new housing units are scrapped within twenty-five years (46 percent within ten years). A survival percentage of .98 might be more reasonable for the future (19 percent scrapped within ten years, 40 percent within twenty-five years).

Equations (58)-(61) apportion total housing units authorized across the categories (1) apartments & duplexes (HADYK); (2) single attached (HSAYK); (3) single detached (HSDYK); and (4) "other." The initial shares (.1572, .1263, .5842, .1323) were taken from the 1981 Census. The terms in TIME represent experienced trends in relative shares over the 1976-1981 inter-censal period.

The equation for the nominal dollar value of residential building permits issued (VPRYK) consists of three basic pieces:

(1) (CPIYK/1.580) - Yukon consumer price index re-based to 1980.

(2) (HADYK,...HOYK(-1))*15.724 - dollar value of permits issued other than single detached, thousands of 1980 dollars.

(3) (HSDYK - HSDYK(1))*70.5 - dollar value of single detached permits authorized, thousands of 1980 dollars.

The factors 15.724 and 70.5 are the estimated per unit cost in thousands of dollars of each type of housing unit in 1980, ($15,724 for other than single detached; $70,500 for single detached). The latter figure was taken from the 1982 first quarter Yukon Economic Review. The former was imputed from published 1981 data for VPRYK after restating to 1980 dollars and netting out the estimated value of single detached units.

6. GOVERNMENT

The econometric literature on government spending suggests that an appropriate model should somehow capture decision makers' preferences or community preferences in an explicitly (or implicitly) formulated utility function, and then derive spending equations via an application of the techniques of constrained maximization.[1/]

Although this general approach has provided many insights into public spending behavior, and has the distinction of at least attempting to avoid the ad hoc, there is no question but that past and potential changes in preferences for public goods present a formidable problem in the context of projecting long term changes in government spending levels and in the composition of public budgets.[2/]

1/ A few references are Thomas Borcherding and Robert Deacon "The Demand For the Services of Non-Federal Governments," American Economic Review, December 1972, pp. 891-901; Theodore Bergstrom and Robert Goodman, "Private Demands For Public Goods," American Economic Review, June 1973, pp. 280-296; and Anthony Atkinson and Joseph Stiglitz, "Theories of the State and Public Economics," Lecture 10 in Lectures On Public Economics, (McGraw Hill, Montreal) 1980.

2/ We say "attempting" to avoid the ad hoc because it is not clear that empirical specifications of public utility functions are anything but ad hoc, guided as they are by the need to formulate a mathematically tractable model. Recent applications of the theory of duality to this problem, in which preferences are implicitly specified via the cost function rest on extreme assumptions as to the consistency of public expenditure decision making.

As Dennis Mueller put it in his recent survey of public choice models:[1/]

> "The extent to which this literature does explain government behavior is still a somewhat debatable question, however. There is an old joke about the man who looks for his watch on the corner with a lamp-post, rather than on the corner where he lost it, because he can see better under the lamp-post. One leaves the empirical literature on representative government with a feeling that some of this behavior underlies the work here."

Current account government spending by category in NEWREM is determined by applying exogenously set spending shares to an aggregate spending variable. At the territorial and local government level, total spending is set equal to total revenue, while at the federal level total spending in the Yukon grows in real per capita terms at an exogenously set rate. Certain categories of territorial and local government revenue are endogenous, in that they are driven by variables determined elsewhere in the model. Investment spending is exogenous.

FEDERAL SPENDING IN THE YUKON

The equations are:

(63) GFYK = CPIYK*NYK*(GFYK(-1)/(CPIYK(-1)*NYK(1)))*(1+A)

(64) GFCYK = GFYK - IGFYK

(65) VGFTYK = SF1*GFCYK

1/ Public Choice, (Cambridge University Press, Cambridge) p. 155.

(66) VGFLYK = SF2*GFCYK

(67) LGFTYK + SF3*GFCYK

(68) VGFBYK = SF4*GFCYK

(69) LGFPYK = SF5*GFCYK

(70) WGFEDYK = SF6*GFCYK

(71) LGFBYK = SF7*GFCYK

(72) VGFPYK = CPIYK*NYK*(-.211 + .069*WSYK/(CPIYK*NYK)
(-1.2) (1.1)
+ 2.02*RUYK/100 -.301*DUM 78)
(1.5) (-3.2)

$\bar{R}^2$ = .97

DW = 1.27

FIT 1967-1978

t-statistics in parentheses

(NOTE: In the computer model the coefficient on DUM78 is subsumed in the intercept. The variable DUM78 equals 1.0 in 1978 and ∅ otherwise.)

(73) GFOCYK = GFCYK - VGFTYK - VGFLYK - LGFTYK - VGFBYK
- VGFPYK - LGFBYK - LGFPYK - WGFEDYK

Only the equation for federal transfers to persons was estimated via ordinary least squares. The 1978 values of the spending share variables are:

SF1 - .541

SF2 - .010

SF3 - .038

SF4 - .007

SF5 - .017

SF6 - .152

SF7 - .057

TERRITORIAL GOVERNMENT REVENUE/SPENDING

The equations are:

(74) VPTYK = -1562.9*DUM6771 + 3135.9*CPIYK + .06285*NYK
(4.4) (2.0)

$\bar{R}^2$ = .99

DW = 1.57

FIT 1967-1978

t-statistics in parentheses

(NOTE: DUM6771 equals 1.0 1967-1971, zero otherwise. It does not appear in the computer model.)

(75) RTINVYK = + .704*RTINVYK(-1) + 85.0*(RTBIL +
(3.6) (1.8)
RTBIL(-1))/2 + (LGTLYK + LGTPYK)*RGC510/100
- (RTLPLYK(-1) + RTLPPYK(-1))*(RGC510(-1) +
RGC510(-2) + RGC510(-3))/300

$\bar{R}^2$ = .91

DW = 1.63

FIT 1970-1978

t-statistics in parentheses

(76) RTITYK= 1299.46 + .03734*YDYK + .04636*TOURXYK

(2.5) (3.6)

$\bar{R}^2$ = .98

DW = 1.34

FIT 1967-1978

t-statistics in parentheses

(77) RTOCYK = CPIYK*EXP(-.725 + .4905*LOG(WSYK/CPIYK)

(-.31)

+ .2839*LOG (TOURXYK/CPIYK))

(1.2)

$\bar{R}^2$ = .98

DW = 1.88

FIT 1967-1978

t-statistics in parentheses

(78) RTLPPYK = .2*(LGTPYK(-1) + LGTPYK(-2) + LGTPYK(-4)

+ LGYPYK(-5))

(79) RTLPLYK = -120.8 + .0285*(LGTLYK(-1) + LGTLYK(-2) +

(-1.2) (3.6)

LGTLYK(-3) + LGTLYK(-4) + LGTLYK(-5)) +

5008.4*RTLPLYK(-1)/(LGTLYK(-1) + LGTLYK(-2) +

(2.3)

LGTLYK(-3) + LGTLYK(-4) + LGTLYK(-5))

$\bar{R}^2$ = .94

DW = 3.04

FIT 1972-1978

t-statistics in parentheses

(80) RTYK = VPTYK + RTINVYK + RTITYK + RTOCYK + RTLPLYK
+ RTLPPYK + VGFTYK + LGFTYK + VGLTYK

(81) GTYK = RTYK + RTDEFYK

(82) GTCYK = GTYK - IGTYK

(83) VGTFYK = ST1*(GRCYK - GTFLNYK)

(84) VGTLYK = ST2*(GTCYK - GTFLNYK)

(85) VGTBYK = ST3*(GTCYK-GTFLNYK)

(86) VGTPKY = ST4*(GTCYK - GTFLNYK)

(87) LGTLYK = ST5*(GTCYK - GTFLNYK)

(88) WGTYK = ST6*(GTCYK - GTLFLNYK)

(89) LGTPYK = ST7*(GTCYK - GTFLNYK)

(90) GTOCYK = GTCYK - VGTFYK - VGTLYK - VGTBYK - VGTPYK -
LGTLYK - WGTYK - LGTPYK

Territorial government revenue includes transfers from persons (VPTYK), investment income (RTINVYK), indirect taxes (RTITYK), "other" current revenue (RTOCYK), loan repayments from persons (RTLPPYK), loan repayments from municipalities and school districts (RTLPLYK) transfers from the federal government (VGFTYK), transfers from local governments (VGLTYK), and loans from the federal government. Transfers and loans from the federal government are determined in the federal government spending sector (equations (65) and (67), above). Transfers from local government are determined in the local government sector (equation (98) below).

Personal transfers to the territorial government are explained as a simple linear function of population and the level of the Yukon consumer price index. Every additional point on the price index adds $3.136 million to transfers, while each additional Yukon resident adds $62.85 to annual transfers.

Investment income (75), is expressed as a function of the previous period's investment income, current and lagged treasury bill rates, interest on new loans to persons and to local public entities, and interest not received on loans repayed the previous year. Inclusion of the lagged income variable dictated the explicit netting out of the interest that would have been received on loans paid out in the previous year. The unitary (absolute value) coefficients on interest from new loans and on interest not earned on loans paid off in the previous year, were both imposed, and the equation fit after netting these two composite variables out of RTINVYK. Given the limited amount of data, this was necessary in order to conserve degrees of freedom without omitting these considerations altogether.

Prior to developing the equation for indirect taxes an examination was made of the tax history for the period since 1967. Because of the relatively large number of different taxes in effect, and the absence of comprehensive data on individual tax bases, a decision was made to impose the assumption that the overall indirect tax burden was the operative consideration

in the determination of rates and new taxes.[1/] In effect, the assumption is that the authorities behave as if they are aware of this overall burden and seek to keep it within rough bounds. This assumption is not refuted by the data as shown in equation (76). Every additional $1,000 in disposable personal income, when spent, yields an additional $37.34 in indirrect tax collections. Every additional $1,000 in tourist expenditure yields marginal revenue of $46.36. Since tourist expenditure is just that, expenditure, while income is partially saved, it is not surprising that an additional dollar of tourist expenditure yields more revenue than an additional dollar of resident income. The implied effective tax rates are 3.73 percent and 4.64 percent, respectively.[2/]

Equation (77) states that the partial elasticity of real "other" current territorial revenue with respect to real wages and salaries equals .4905, while the parital elasticity with respect to tourist expenditure equals .2839. Again, the assumption has been imposed that the authorities behave <u>as if</u> they are aware of overall burden and seek to stay within certain bounds. For purposes of long run policy simulation this assumption may be the most appropriate to make, since it prevents the model from generating unduly high or low revenue estimates, while at the same time not foreclosing the option of simply add-factoring the revenue equations.

1/ Indirect taxes levied in 1982 include the following: motor gasoline, diesel fuel, aviation fuel, heating oil, property, school tax, insurance tax, tobacco tax, and an alcoholic beverage tax.

2/ On disposable income and tourist expenditure.

In arriving at the coefficients in (77) two regressions were run because it proved impossible to obtain a sensible positive coefficient on real tourist expenditure otherwise. In the first, only real wages and salaries was used as an explanatory variable. In this regression the coefficient .4905 was obtained. The second regression fit LOG(RTOCYK/CPIYK) - .4905*LOG(WSYK/CPIYK) to a constant and LOG(TOURXYK/CPIYK). The results of the second regression are reported in (77).

The equation for loan repayments by persons (78) has been postulated. Over the 1967-1978 period the territorial government loaned to persons a total of $2.079 million and received back only $1.105 million. For the five years 1974-1978 loans to persons were $14,000; $6,000; $2,000; zero; and zero. Over the same period loan repayments were $234,000; $16,000; $28,000; $358,000; and zero. Using equation (78) estimated loan repayments by persons in 1979 would be $4,400. Because it was felt that a long-term policy simulation model should relate loan repayments to previous loans made, and because there appeared to be no pattern in the historical data, the decision was made to assume that in any one future year loans made would consist of 20 percent five year loans, 20 percent four year loans, 20 percent three year loans, 20 percent two year loans, and 20 percent one year loans. Using this equation (or a similar equation) policy simulations include the assumption that all loans to persons are, in fact, repaid.

Equation (79) identifies a consistent historical pattern of loan repayments from municipalities and school districts. At this writing we are not convinced that it should remain in the model. It may be preferable to impose an equation such as (78).

Equation (80) is an identity giving total territorial government revenue.

The territorial government current spending equations operate by applying an exogenously imposed share to total current account expenditure net of territorial government loan repayments to the federal government, (equations (83)-(89)). A top down approach is adopted. Total spending equals total revenue plus an exogenously imposed deficit, (equation (81). Current account spending equals total spending less exogenous investment expenditure (equation (82)).

In 1978 the values of the spending share variables were:

ST1 - .1040

ST2 - .0478

ST3 .0260

ST4 - .0520

ST5 - .0666

St6 - .3526

ST7 - Ø

LOCAL GOVERNMENT REVENUE/SPENDING

The equations are:

(91) RLINVYK = EXP(1.7953 + .546*LOG(RTBIL/100)*(RLOCYK +
(1.8) (2.1)
RLITYK + VGFLYK + VGTLYK - WGLYK - GLOCYK))

$\bar{R}^2$ = .98

DW = 1.65

FIT 1972-1978

t-statistics in parentheses

(92) RLITYK = 81.5536 + .0107*YDYK + .0242*TOURXYK
(0.6) (3.7) (1.7)

$\bar{R}^2$ = .98

DW = 2.17

FIT 1967-1978

t-statistics in parentheses

(93) RLOCYK = -554.81 + .0193*YDYK
(-4.0) (13.3)

$\bar{R}^2$ = .97

DW = 1.36

FIT 1967-1978

t-statistics in parentheses

(94) RLYK = VPLYK + RLINVYK + RLITYK + RLOCYK + VGFLYK +
VGTLYK + LGTLYK

(95) GLYK = RLYK + RLDEFYK

(96) GLCYK = GLYK - IGLYK

(97) WGLYK = SL6*(GLCYK - RTLPLYK)

(98) VGLTYK = SL1*(GLCYK - RTLPLYK)

(99) VGLPYK = SL2*(GLCYK - RTLPLYK)

(100) GLOCYK = GLCYK - WGLYK - VGLTYK - VGLPYK - RTLPLYK

Investment income of Yukon local governments (RLINVYK) increases 5.46 percent every 10 percent increase in the product of the Canadian treasury bill rate and a cash flow proxy variable, (equation (91)). Judging by the relatively small and constant size of local government investment income, revenue from this source is derived by holding a portion of municipal and school district cash balances in interest bearing accounts.[1/] The cashflow proxy used here is expected to be positive at all times and closely correllated with cashflow, (the latter judging from the fit in (91)). One would not wish to use the deficit/surplus for this purpose, since investment earnings can be positive even when the surplus for the year is negative.

The equation for local government indirect taxes follows the rationale laid out above in territorial government indirect taxes. For every extra $1,000 of disposable income, local government indirect taxes increase by $10.70. For every extra dollar of tourist expenditure local government indirect taxes rise by $24.20. The implied effective marginal tax rates are 1.07 percent and 2.42 percent, respectively, based on average historical spending patterns.

1/ Investment income in thousands of dollars for the years 1967 to 1978: 7, 15, 32, 20, 23, 30, 39, 40, 32, 113, 114, 20.

Equation (93) states that $19.30 of "other" current local government revenue is obtained for every extra $1,000 of disposable income generated in the Yukon economy.

The revenue variables VGTLYK and LGTLYK are determined in the territorial government spending sector; the variable VGFLYK in the federal spending sector. Transfer payments from persons to local government are exogenous (VPLYK), and equaled $31 thousand in 1978.

Local government spending equations adopt the share approach used for federal spending and for territorial government spending. The 1978 values of the shares are:

SL1 - .0862

SL2 - .0062

SL6 - .2372

7. OTHER EQUATIONS IN NEWYEM

The remaining equations in NEWYEM project the Yukon Consumer Price Index (CPIYK), nonresidential building permits (VBPNRYK), the number of border crossings (TOURNYK), the level of "tourist" expenditure (TOURXYK), total government investment (IGYK), the number of business establishments in the services industry (NBSVYK), and the number of business establishments outside the services industry. (NBNSVYK).

CONSUMER PRICE INDEX

The annual Yukon Consumer Price Index has been constructed as a population weighted average of temporal price indexes for Whitehorse, Dawson City, and Watson Lake. Details of its construction can be found in Appendix A. The NEWYEM forecasting equation simply relates the Yukon price inflation experience to the National over the June 1976 to September 1982 period for which data are available.

(101) CPIYK = CPIYK(-1) + .0022 + 1.174*((CPI-CPI(-1))/
(.16) (3.4)
CPI(-1))*CPIYK(-1)

R^{-2} = .97

DW = 1.52

FIT June 1976-September 1982

(19 monthly observations)

Equation (101) was estimated in percent change form.

NONRESIDENTIAL BUILDING PERMITS

Nonresidential building permits typically lead (rather than lag) economic activity. Because of the paucity of data for the Yukon such a relationship could not be statistically estimated. Therefore, the premise upon which the equation's specification is based is that, for long term policy simulation purposes, having an equation which at least tracks economic activity is preferable to leaving this variable exogenous. Should a case arise where the leading indicator properties of nonresidential construction activity are important, the model can be addfactored, or alternatively, the variable can be exogenized. The equation used in NEWYEM is:

(102) VBPNRYK = CPIYK*(24666.3 + 3.92*(ETOTYK + ETOTYK(-1))/2)
(-0.8) (1.1)

$\bar{R}^{-2}$ = .50

DW = 2.16

FIT 1972-1981

t-statistics in parentheses

The large negative intercept would not cause building permits to turn negative unless employment dropped below 6300 jobs, a figure approximately 40 percent below the 1981 level. At the margin, every 100 new jobs generates $392,000 in new real nonresidential building permits.[1/]

1/ The coefficients in this equation are very sensitive to sample specification. For example, the same equation fit 1977-1981 yielded coefficients of -64963 and 8.45, on the intercept and slope, respectively.

TOURISM

In NEWYEM the number of tourists is defined to equal border crossings. The tourism sector of NEWYEM consists of two equations, one projecting the number of tourists (TOURNYK), the other projecting tourist expenditure (TOURXYK). The equations are:

(103) TOURNYK = 73862.2*YD/(CPI*N) + 65376.3*LOG(TIME) -
(2.9) (3.0)
104392*XRTE
(-1.9)

R^{-2} = .99

DW = 1.25

FIT 1967-1981

t-statistics in parentheses

(104) TOURXYK = .0808*TOURNYK*CPIYK

For every $1000 increase in real per capita Canadian disposable income (the 1981 level was only $3921), an additional 73,862 border crossings (TOURNYK) are projected by equation (103). The variable in the log of TIME adds approximately 4300 border crossings per year in the early to middle 1980's, declining to approximately 1900 per year by the year 2000.

The U.S.-Canadian spot exchange rate (XRTE) carries a negative coefficient in (103). The implication is that for every 10¢

by which the spot rate increases (it is presently at $.81), border crossings decline by 10439. The direction of the effect is as expected. A rise in the Canadian dollar against the U.S. dollar discourages U.S. tourism in Canada and encourages Canadians to visit the United States rather than their own country.

Per capita tourist expenditure is set at the 1975-1981 mean real per tourist level of $80.80 per border crossing. For the years 1975-1981, estimated real per tourist expenditure was respectively: $93.70, $68.10, $88.40, $78.90, $78.90, $81.80, and $76.00.

These low per-tourist real expenditure levels undoubtedly reflect the fact that many Yukon "tourists" simply pass through on their way to or from Alaska via the Alaska-Canada Highway.

NUMBER OF BUSINESS ESTABLISHMENTS

These two equations were included in NEWYEM because their dependent variables are needed to drive the energy model. The two equations are:

(105) NBSVYK = 168.2 + .2076*ESVYK

(3.1) (9.2)

R^{-2} = .999

DW = 3.47

FIT 1977-1981

t-statistics in parentheses

(106) NBNSVYK = 1029.5 + .0610*NYK

(-2.8) (4.0)

R^{-2} = .997

DW = 3.13

FIT 1977-1981

t-statistics in parentheses

For every five new jobs created in the services industry, one new service industry business establishment is projected to open. For every 16.4 person increase in the Yukon population, one new business establishment is opened outside the service industry.

The final equation to be discussed is an identity expressing total government investment spending as the sum of its components.

(107) IGYK = IGFYK + IGTYK + IGLYK

8. COHORT-SURVIVAL MODEL

Most cohort-survival models are theoretically standard, differing only in the assumptions supplied the standard equations, in the number of single-age, age groups within a cell, and in the population to which they are applied. The Yukon cohort-survival model contains forty cells defined by age, race, and sex. The cell delineators are:

AGE: 0-4, 5-9, 10-14, 15-19, 20-24, 25-34, 35-44, 45-54, 55-64, 65 and over

RACE: Native, Non-Native

SEX: Male, Female

The model is nearly self-contained, in that the only exogenous variables that must be supplied are base year population for each cell, and total Yukon net migration (NMIGYK). A printout of the model written in the Time Series Processor language (TSP)[1/] is included in this section. In order to ease understanding of the mnemonic structure three equations are given below and explained.

(1) Non-Native males ages 20 to 24

```
MNN2024 = .8*(MNN2024(-1)-DM2024(-1)*MNN2024(-1)) +
          .2*(MNN1519(-1)-DM1519(-1)*MNN1519(-1)) -
          DM2024(-1)*MNN2024(-1) + MM2024*NMIGYK
```

1/ TSP International, Palo Alto, California.

where: MNN2024 is the current year's population of non-native (NN) males (M) ages 20 to 24 (2024).

DM2024 is the death rate for non-native males ages 20 to 24.

MNN1519(-1) is the previous year's population of non-native males ages 15 to 19.

DM1519 is the death rate for non-native males ages 15 to 19.

and: MM2024 is the percent of total net migration assumed to be non-native males ages 20 to 24.

In words, equation (1) says that the current year population equals 80 percent of the previous year's population that did not die (the other 20 percent grew out of the five year age group); plus 20 percent of the previous year's population one age group younger (except for those who died); less deaths; plus a share of net migration.

(2) Non-native males ages 0 to 4

$$MNN04 = .8*(MNN04(-1) - DM04(-1)*MNN04(-1)) + BM - DM04(-1)*MNN04(-1) + MM04*NMIGYK$$

This equation differs from (1) by the substitution of births of non-native males (BM) for persons growing into the cell from the next youngest cell.

(3) Births of Non-Native males

BM = BP04*FNN04 + BP59*FNN59 +...+ BP65*FNN65

where: BM is live births of non-native males.

BP04,... are fertility rates for females ages 0-4, 5-9, ..., 65 and over.

FNN04,... is the non-native female population by age group, (set equal to zero for age groups outside the 15-44 age range).

All mnemonics that are cell-specific end with an age designator. The concepts used in the model and their mnemonic structure are:

	NATIVE MALE	NATIVE FEMALE	NON-NATIVE MALE	NON-NATIVE FEMALE
Fertility rates	(NA)	BPN	(NA)	BP
Death rates	DMN	DFN	DM	DF
Migration Shares	MMN	MFN	MM	MF
Births (No.) 1/	BMN	BFN	BM	BF
Population	MN	FN	MNN	FNN

The following mnemonics are used for selected summary variables:

BCHYK - Total births both sexes and races.

DCHYK - Total deaths both sexes and races.

NNNMYK - Population count, non-native males.

NNNFYK - Population count, non-native females.

1/ No age-group tag on births for obvious reasons.

NNMYK - Population count, Native males.

NNFYK - Population count, Native females.

NNNYK - Population count, non-Natives.

NNYK - Population count, Natives.

NCHYK - Total population as projected by the cohort-survival model (the mnemonic NCHYK is used instead of NYK to separately identify this projection from that of NEWYEM).

```
FILE: BDMOD     DATA      A1  VM/SP CMS (FUTE108+) - 02/13/83

NAME GGRANT 'COHORT SURVIVAL MODEL'. ;
REPL;
SMPL 7 7;LOAD ; ? LOADING 1981 STARTING POPULATION ;
SMPL 7 32 ;
? BIRTH RATES (PER FEMALE).;
GENR BP04=0  ;
GENR BP59=0 ;
GENR BP1014=0;
GENR BP1519=.0445 ;
GENR BP2024=.1208 ;
GENR BP2534=.1152;
GENR BP3544=.0108;
GENR BP4554=0;
GENR BP5564=0;
GENR BP65=0;
GENR BPN04=0;
GENR BPN59=0;
GENR BPN1014=0;
GENR BPN1519=.0445;
GENR BPN2024=.1208;
GENR BPN2534=.1152;
GENR BPN3544=.0108;
GENR BPN4554=0;
GENR BPN5564=0;
GENR BPN65=0;
? DEATH RATES ;
GENR DM04=.0038;
GENR DM59=.0040;
GENR DM1014=.0042;
GENR DM1519=.0044;
GENR DM2024=.0046;
GENR DM2534=.0053;
GENR DM3544=.0059;
GENR DM4554=.0120;
GENR DM5564=.0106;
GENR DM65=0;
GENR DF04=.0051;
GENR DF59=.0041;
GENR DF1014=.0031;
GENR DF1519=.0020;
GENR DF2024=.0016;
GENR DF2534=.0012;
GENR DF3544=.0029;
GENR DF4554=.0066;
GENR DF5564=.0154;
GENR DF65=.145;
GENR DMN04=.0038;
GENR DMN59=.0040;
GENR DMN1014=.0042;
GENR DMN1519=.0044;
GENR DMN2024=.0046;
GENR DMN2534=.0053;
GENR DMN3544=.0059;
GENR DMN4554=.0120;
GENR DMN5564=.0106;
```

```
FILE: BDMOD     DATA      A1  VM/SP CMS (PUT8108+) - 02/13/83

GENR DMN65=.145;
GENR DFN04=.0051;
GENR DFN59=.0041;
GENR DFN1014=.0031;
GENR DFN1519=.0020;
GENR DFN2024=.0016;
GENR DFN2534=.0012;
GENR DFN3544=.0029;
GENR DFN4554=.0066;
GENR DFN5564=.0154;
GENR DFN65=.145;
? MIGRATION PERCENTAGES. APPLIED TO NMIGYR. ;
GENR MF04=.046;
GENR MFN04=0;
GENR MM04=.050;
GENR MMN04=0;
GENR MF59=.046;
GENR MFN59=0;
GENR MM59=.050;
GENR MMN59=0;
GENR MF1014=.0384;
GENR MFN1014=0;
GENR MM1014=.0426;
GENR MMN1014=0;
GENR MF1519=.0498;
GENR MFN1519=0;
GENR MM1519=.0552;
GENR MMN1519=0;
GENR MF2024=.073;
GENR MFN2024=0;
GENR MM2024=.0810;
GENR MMN2024=0;
GENR MF2534=.1238;
GENR MFN2534=0;
GENR MM2534=.1372;
GENR MMN2534=0;
GENR MF3544=.0531;
GENR MFN3544=0;
GENR MM3544=.0589;
GENR MMN3544=0;
GENR MF4554=.0275;
GENR MFN4554=0;
GENR MM4554=.0305;
GENR MMN4554=0;
GENR MF5564=.0088;
GENR MFN5564=0;
GENR MM5564=.0097;
GENR MMN5564=0;
GENR MF65=.0088;
GENR MFN65=0;
GENR MM65=.0097;
GENR MMN65=0;
SMPL 8 32 ;
? NON-NATIVE MALES ;
FRML BMQ BM=BP04*FNN04+BP59*FNN59+BP1014*FNN1014+BP1519*FNN1519+BP2024*
```

```
FILE: BDMCD     DATA     A1  VM/SP CMS (FUT8108+) - 02/13/83

FNN2024+BP2534*FNN2534+BP3544*FNN3544+BP4554*FNN4554+BP5564*FNN5564+
BP65*FNN65 ;
FRML MNN04Q MNN04=.8*(MNN04(-1)-DM04(-1)*MNN04(-1))+BM-DM04(-1)*
MNN04(-1)+MM04*NMIGYK  ;
FRML MNN59Q MNN59=.8*(MNN59(-1)-DM59(-1)*MNN59(-1))+.2*(MNN04(-1)-
DM04(-1)*MNN04(-1))-DM59(-1)*MNN59(-1)+MM59*NMIGYK ;
FRML MNN1014Q MNN1014=.8*(MNN1014(-1)-DM1014(-1)*MNN1014(-1))+.2*
(MNN59(-1)-DM59(-1) *MNN59(-1))-DM1014(-1)*MNN1014(-1)+MM1014*NMIGYK ;
FRML MNN1519Q MNN1519=.8*(MNN1519(-1)-DM1519(-1)*MNN1519(-1))+.2*
(MNN1014(-1)-DM1014(-1)*MNN1014(-1))-DM1519(-1)*MNN1519(-1)+
MM1519*NMIGYK ;
FRML MNN2024Q MNN2024= .8*(MNN2024(-1)-DM2024(-1)*MNN2024(-1))+
.2*(MNN1519(-1)-DM1519(-1)*MNN1519(-1))-DM2024(-1)*MNN2024(-1)+
MM2024*NMIGYK ;
FRML MNN2534Q MNN2534=.9*(MNN2534(-1)-DM2534(-1)*MNN2534(-1))+
.2*(MNN2024(-1)-DM2024(-1)*MNN2024(-1))-DM2534(-1)*MNN2534(-1)+
MM2534*NMIGYK ;
FRML MNN3544Q MNN3544=.9*(MNN3544(-1)-DM3544(-1)*MNN3544(-1))+
.1*(MNN2534(-1)-DM2534(-1)*MNN2534(-1))-DM3544(-1)*
MNN3544(-1)+MM3544*NMIGYK ;
FRML MNN4554Q MNN4554=.9*(MNN4554(-1)-DM4554(-1)*MNN4554(-1))+
.1*(MNN3544(-1)-DM3544(-1)*MNN3544(-1))-DM4554(-1)*MNN4554(-1)+
MM4554*NMIGYK ;
FRML MNN5564Q MNN5564=.9*(MNN5564(-1)-DM5564(-1)*MNN5564(-1))+
.1*(MNN4554(-1)-DM4554(-1)*MNN4554(-1))-DM5564(-1)*MNN5564(-1)+
MM5564*NMIGYK ;
FRML MNN65Q MNN65=MNN65(-1)-DM65(-1)*MNN65(-1)+.1*(MNN5564(-1)-
DM5564(-1)*MNN5564(-1))+MM65*NMIGYK ;
? NON-NATIVE FEMALES ;
FRML BFQ BF=BP04*FNN04+BP59*FNN59+BP1014*FNN1014+BP1519*FNN1519+BP2024*
FNN2024+BP2534*FNN2534+BP3544*FNN3544+BP4554*FNN4554+BP5564*FNN5564+
BP65*FNN65 ;
FRML FNN04Q FNN04=.8*(FNN04(-1)-DF04(-1)*FNN04(-1))+BF-DF04(-1)*
FNN04(-1)+MF04*NMIGYK  ;
FRML FNN59Q FNN59=.8*(FNN59(-1)-DF59(-1)*FNN59(-1))+.2*(FNN04(-1)-
DF04(-1)*FNN04(-1))-DF59(-1)*FNN59(-1)+MF59*NMIGYK ;
FRML FNN1014Q FNN1014=.8*(FNN1014(-1)-DF1014(-1)*FNN1014(-1))+.2*
(FNN59(-1)-DF59(-1)*FNN59(-1))-DF1014(-1)*FNN1014(-1)+MF1014*NMIGYK ;
FRML FNN1519Q FNN1519=.8*(FNN1519(-1)-DF1519(-1)*FNN1519(-1))+
.2*(FNN1014(-1)-DF1014(-1)*FNN1014(-1))-DF1519(-1)*FNN1519(-1)+
MF1519*NMIGYK ;
FRML FNN2024Q FNN2024= .8*(FNN2024(-1)-DF2024(-1)*FNN2024(-1))+
.2*(FNN1519(-1)-DF1519(-1)*FNN1519(-1))-DF2024(-1)*FNN2024(-1)+
MF2024*NMIGYK ;
FRML FNN2534Q FNN2534=.9*(FNN2534(-1)-DF2534(-1)*FNN2534(-1))+
.2*(FNN2024(-1)-DF2024(-1)*FNN2024(-1))-DF2534(-1)*FNN2534(-1)+
MF2534*NMIGYK ;
FRML FNN3544Q FNN3544=.9*(FNN3544(-1)-DF3544(-1)*FNN3544(-1))+
.1*(FNN2534(-1)-DF2534(-1)*FNN2534(-1))-DF3544(-1)*
FNN3544(-1)+MF3544*NMIGYK ;
FRML FNN4554Q FNN4554=.9*(FNN4554(-1)-DF4554(-1)*FNN4554(-1))+
.1*(FNN3544(-1)-DF3544(-1)*FNN3544(-1))-DF4554(-1)*FNN4554(-1)+
MF4554*NMIGYK ;
FRML FNN5564Q FNN5564=.9*(FNN5564(-1)-DF5564(-1)*FNN5564(-1))+
.1*(FNN4554(-1)-DF4554(-1)*FNN4554(-1))-DF5564(-1)*FNN5564(-1)+
```

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FILE: BDMOD     DATA     A1  VM/SP CMS (PUT8108+) - 02/13/83

MF5564*NMIGYK ;
FRML FNN65Q FNN65=FNN65(-1)-DF65(-1)*FNN65(-1)+.1*(FNN5564(-1)-
DF5564(-1)*FNN5564(-1))+MF65*NMIGYK ;
? NATIVE MALES ;
FRML BMNQ BMN=BPN04*FN04+BPN59*FN59+BPN1014*FN1014+BPN1519*FN1519+BPN2024*
FN2024+BPN2534*FN2534+BPN3544*FN3544+BPN4554*FN4554+BPN5564*FN5564+
BPN65*FN65 ;
FRML MN04Q MN04=.8*(MN04(-1)-DMN04(-1)*MN04(-1))+BMN-DMN04(-1)*
MN04(-1)+MMN04*NMIGYK;
FRML MN59Q MN59=.8*(MN59(-1)-DMN59(-1)*MN59(-1))+.2*(MN04(-1)-
DMN04(-1)*MN04(-1))-DMN59(-1)*MN59(-1)+MMN59*NMIGYK ;
FRML MN1014Q MN1014=.8*(MN1014(-1)-DMN1014(-1)*MN1014(-1))+.2*
(MN59(-1)-DMN59(-1)*MN59(-1))-DMN1014(-1)*MN1014(-1)+MMN1014*NMIGYK ;
FRML MN1519Q MN1519=.8*(MN1519(-1)-DMN1519(-1)*MN1519(-1))+.2*
(MN1014(-1)-DMN1014(-1)*MN1014(-1))-DMN1519(-1)*MN1519(-1)+
MMN1519*NMIGYK ;
FRML MN2024Q MN2024= .8*(MN2024(-1)-DMN2024(-1)*MN2024(-1))+
.2*(MN1519(-1)-DMN1519(-1)*MN1519(-1))-DMN2024(-1)*MN2024(-1)+
MMN2024*NMIGYK ;
FRML MN2534Q MN2534=.9*(MN2534(-1)-DMN2534(-1)*MN2534(-1))+
.2*(MN2024(-1)-DMN2024(-1)*MN2024(-1))-DMN2534(-1)*MN2534(-1)+
MMN2534*NMIGYK ;
FRML MN3544Q MN3544=.9*(MN3544(-1)-DMN3544(-1)*MN3544(-1))+
.1*(MN2534(-1)-DMN2534(-1)*MN2534(-1))-DMN3544(-1)*
MN3544(-1)+MMN3544*NMIGYK ;
FRML MN4554Q MN4554=.9*(MN4554(-1)-DMN4554(-1)*MN4554(-1))+
.1*(MN3544(-1)-DMN3544(-1)*MN3544(-1))-DMN4554(-1)*MN4554(-1)+
MMN4554*NMIGYK ;
FRML MN5564Q MN5564=.9*(MN5564(-1)-DMN5564(-1)*MN5564(-1))+
.1*(MN4554(-1)-DMN4554(-1)*MN4554(-1))-DMN5564(-1)*MN5564(-1)+
MMN5564*NMIGYK ;
FRML MN65Q MN65=MN65(-1)-DMN65(-1)*MN65(-1)+.1*(MN5564(-1)-
DMN5564(-1)*MN5564(-1))+MMN65*NMIGYK ;
? NATIVE FEMALES ;
FRML BFNQ BFN=BPN04*FN04+BPN59*FN59+BPN1014*FN1014+BPN1519*FN1519+BPN2024*
FN2024+BPN2534*FN2534+BPN3544*FN3544+BPN4554*FN4554+BPN5564*FN5564+
BPN65*FN65 ;
FRML FN04Q FN04=.8*(FN04(-1)-DFN04(-1)*FN04(-1))+BFN-DFN04(-1)*
FN04(-1)+MFN04*NMIGYK;
FRML FN59Q FN59=.8*(FN59(-1)-DFN59(-1)*FN59(-1))+.2*(FN04(-1)-
DFN04(-1)*FN04(-1))-DFN59(-1)*FN59(-1)+MFN59*NMIGYK ;
FRML FN1014Q FN1014=.8*(FN1014(-1)-DFN1014(-1)*FN1014(-1))+.2*
(FN59(-1)-DFN59(-1)*FN59(-1))-DFN1014(-1)*FN1014(-1)+MFN1014*NMIGYK ;
FRML FN1519Q FN1519=.8*(FN1519(-1)-DFN1519(-1)*FN1519(-1))+.2*
(FN1014(-1)-DFN1014(-1)*FN1014(-1))-DFN1519(-1)*FN1519(-1)+
MFN1519*NMIGYK ;
FRML FN2024Q FN2024= .8*(FN2024(-1)-DFN2024(-1)*FN2024(-1))+
.2*(FN1519(-1)-DFN1519(-1)*FN1519(-1))-DFN2024(-1)*FN2024(-1)+
MFN2024*NMIGYK ;
FRML FN2534Q FN2534=.9*(FN2534(-1)-DFN2534(-1)*FN2534(-1))+
.2*(FN2024(-1)-DFN2024(-1)*FN2024(-1))-DFN2534(-1)*FN2534(-1)+
MFN2534*NMIGYK ;
FRML FN3544Q FN3544=.9*(FN3544(-1)-DFN3544(-1)*FN3544(-1))+
.1*(FN2534(-1)-DFN2534(-1)*FN2534(-1))-DFN3544(-1)*
FN3544(-1)+MFN3544*NMIGYK ;
```

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FILE: BDMOD     DATA      A1  VM/SP CMS (PUT8108+) - 02/13/83

FRML FN4554G FN4554=.9*(FN4554(-1)-DFN4554(-1)*FN4554(-1))+
.1*(FN3544(-1)-DFN3544(-1)*FN3544(-1))-DFN4554(-1)*FN4554(-1)+
MFN4554*NMIGYK ;
FRML FN5564Q FN5564=.9*(FN5564(-1)-DFN5564(-1)*FN5564(-1))+
.1*(FN4554(-1)-DFN4554(-1)*FN4554(-1))-DFN5564(-1)*FN5564(-1)+
MFN5564*NMIGYK ;
FRML FN65G FN65=FN65(-1)-DFN65(-1)*FN65(-1)+.1*(FN5564(-1)-
DFN5564(-1)*FN5564(-1))+MFN65*NMIGYK ;
FRML BCHYKQ BCHYK=BM+BF+BMN+BFN;
FRML DNNYKQ DNNYK=DM04(-1)*MNN04(-1)+DM59(-1)*MNN59(-1)+
DM1014(-1)*MNN1014(-1)+DM1519(-1)*MNN1519(-1)+DM2024(-1)*
MNN2024(-1)+DM2534(-1)*MNN2534(-1)+DM3544(-1)*MNN3544(-1)+
DM4554(-1)*MNN4554(-1)+DM5564(-1)*MNN5564(-1)+DM65(-1)*
MNN65(-1)+DF04(-1)*FNN04(-1)+DF59(-1)*FNN59(-1)+DF1014(-1)*
FNN1014(-1)+DF1519(-1)*FNN1519(-1)+DF2024(-1)*FNN2024(-1)+
DF2534(-1)*FNN2534(-1)+DF3544(-1)*FNN3544(-1)+DF4554(-1)*
FNN4554(-1)+DF5564(-1)*FNN5564(-1)+DF65(-1)*FNN65(-1);
FRML DNYKG DNYK=DMN04(-1)*MN04(-1)+DMN59(-1)*MN59(-1)+
DMN1014(-1)*MN1014(-1)+DMN1519(-1)*MN1519(-1)+DMN2024(-1)*
MN2024(-1)+DMN2534(-1)*MN2534(-1)+DMN3544(-1)*MN3544(-1)+
DMN4554(-1)*MN4554(-1)+DMN5564(-1)*MN5564(-1)+DMN65(-1)*
MN65(-1)+DFN04(-1)*FN04(-1)+DFN59(-1)*FN59(-1)+DFN1014(-1)*
FN1014(-1)+DFN1519(-1)*FN1519(-1)+DFN2024(-1)*FN2024(-1)+
DFN2534(-1)*FN2534(-1)+DFN3544(-1)*FN3544(-1)+DFN4554(-1)*
FN4554(-1)+DFN5564(-1)*FN5564(-1)+DFN65(-1)*FN65(-1);
FRML DCHYKQ DCHYK=DNNYK+DNYK;
FRML NNNMYKG NNNMYK=MNN04+MNN59+MNN1014+MNN1519+MNN2024+
MNN2534+MNN3544+MNN4554+MNN5564+MNN65 ;
FRML NNNFYKQ NNNFYK=FNN04+FNN59+FNN1014+FNN1519+FNN2024+
FNN2534+FNN3544+FNN4554+FNN5564+FNN65 ;
FRML NNMYKG NNMYK=MN04+MN59+MN1014+MN1519+MN2024+MN2534+
MN3544+MN4554+MN5564+MN65 ;
FRML NNFYKQ NNFYK=FN04+FN59+FN1014+FN1519+FN2024+FN2534+
FN3544+FN4554+FN5564+FN65 ;
FRML NNNYKQ NNNYK=NNNMYK+NNNFYK;
FRML NNYKG NNYK=NNFYK+NNNMYK;
FRML NCHYKQ NCHYK=NNNYK+NNYK;


LIST Y1,BMQ,MNN04Q,MNN59Q,MNN1014G,MNN1519G,MNN2024G,MNN2534G,
MNN3544G,MNN4554Q,MNN5564Q,MNN65G,FNN04G,FNN59G,FNN1014G,
FNN1519Q,FNN2024Q,FNN2534Q,FNN3544G,FNN4554G,FNN5564Q,FNN65G,
MN04Q,MN59Q,MN1014Q,MN1519Q,MN2024G,MN2534Q,MN3544G,MN4554G,
MN5564Q,MN65Q,FN04Q,FN59Q,FN1014Q,FN1519G,FN2024Q,FN2534G,
FN3544Q,FN4554Q,FN5564Q,FN65Q,BFQ,BFNG,BMNQ ,
BCHYKQ,DNNYKQ,DNYKQ,DCHYKQ,NNNMYKG,NNNFYKG,NNMYKQ,NNFYKG,
NNNYKQ,NNYKG,NCHYKG;
LIST Y2,BM,MNN04,MNN59,MNN1014,MNN1519,MNN2024,MNN2534,MNN3544,
MNN4554,MNN5564,MNN65,FNN04,FNN59,FNN1014,FNN1519,FNN2024,FNN2534,
FNN3544,FNN4554,FNN5564,FNN65,MN04,MN59,MN1014,MN1519,MN2024,MN2534,
MN3544,MN4554,MN5564,MN65,FN04,FN59,FN1014,FN1519,FN2024,FN2534,FN3544,
FN4554,FN5564,FN65,BF,BFN,BMN ,BCHYK,DNNYK,DNYK,DCHYK,NNNMYK,
NNNFYK,NNMYK,NNFYK,NNNYK,NNYK,NCHYK;
COLECT Y1,Y2,BDMODX ;
```

```
FILE: BDMCD     DATA     A1  VM/SP CMS (PUT2102+) - 02/13/83

SOLVE(DYNAM,PRNSIM)BDMCDX ;
STOP; END;
LOAD MNN04 ;
1023 ;
LOAD MNN59;
919;
LOAD MNN1014;
936;
LOAD MNN1519;
1029;
LOAD MNN2024;
796;
LOAD MNN2534;
2265;
LOAD MNN3544;
1404;
LOAD MNN4554;
918;
LOAD MNN5564;
524;
LOAD MNN65;
112;
LOAD FNN04;
960;
LOAD FNN59;
859;
LOAD FNN1014;
891;
LOAD FNN1519;
897;
LOAD FNN2024;
939;
LOAD FNN2534;
2188;
LOAD FNN3544;
1193;
LOAD FNN4554;
651;
LOAD FNN5564;
419;
LOAD FNN65;
197;
LOAD MN04;
62;
LOAD MN59;
91;
LOAD MN1014;
119;
LOAD MN1519;
140;
LOAD MN2024;
334;
LOAD MN2534;
470;
LOAD MN3544;
```

```
361;
LOAD MN4554;
207;
LOAD MN5564;
161;
LOAD MN65;
303;
LOAD FN04;
55;
LOAD FN59;
96;
LOAD FN1014;
84;
LOAD FN1519;
143;
LOAD FN2024;
301;
LOAD FN2534;
507;
LOAD FN3544;
242;
LOAD FN4554;
139;
LOAD FN5564;
101;
LOAD FN65;
123;
LOAD BM;
210;
LOAD BMN;
79;
LOAD BF;
184;
LOAD BFN;
52;
LOAD BCMYK;
525;
LOAD DKMYK;
0;
LOAD DNYK;
0;
LOAD DCMYK;
0;
LOAD NNNMYK;
0;
LOAD NNNFYK;
0;
LOAD NNMYK;
0;
LOAD NNFYK;
0;
LOAD NNNYK;
0;
LOAD NNYK;
0;
```

```
FILE: BDMLD     DATA      A1  VM/SP CMS (PLT810E+1 - 02/13/83

LOAD NCHYK:
0;
SMPL 8 32 ;
LOAD NM1GYK;
90 90 90 90 90 90 90 90 90 90 90 50 90 50 9C 50 90
90 90 90 50 90 90 9C 50 ;
END;
```

9. YUKON ENERGY MODEL

The Yukon energy model projects energy demand by sector, end use, and fuel type for the time period 1978 to 2006. Base year data for 1978 were obtained from Northern Energy, a publication of the Yukon Conservation Society.[1/] To our knowledge, this publication contains the most careful, comprehensive, point-in-time estimates which are available for the Yukon Territory. The model is not econometric but is driven by variables obtained from a previous simulation of the Yukon Economic Model (NEWYEM). The driver variables are:

the number of tourists	- TOURNYK
the number of households	- HHYK
disposable personal income	- YDYK
population	- NYK
the Yukon CPI	- CPIYK
establishments in services	- NBSVYK
employment	- ELUMYK, ESVYK, ECUYK, EGFEDYK, EGTYK, EGLYK, EMIPYK, EMIXYK, ECYK, EOYK
mine output	- QMICAYK, QMIUKYK

1/ Hodge, R.A. and Ehrlich, L., Northern Energy, Yukon Conservation Society, Whitehorse, Yukon, January 1983.

A printout of the TSP program used to solve the energy model is given below along with a list of mnemonics and their definitions. The following points and definitions should be kept in mind when studying or using the model.

(1) Sectors modelled are Commercial/Government, Residential, Industrial, and Transportation.

(2) Base year data were not available for all demand and price variables. Where data were absent, index numbers have been used. This problem afflicts the industrial sector and the transportation sector.

(3) A terajoule is one trillion joules, or approximately 948 million British thermal units.

(4) Delivered terajoules define the heat value of a fuel at the input to the burning device.

(5) An effective terajoule equals a delivered terajoule times the efficiency factor of the burning device. For example, a typical home furnance (oil) delivers .65 effective terajoules of heat for every 1.0 terajoules of energy supplied to it.

(6) The model projects demand in effective terajoules and then converts via identity to delivered terajoules and units.

(7) Physical units employed are: megawatt hours (electricity), kiloliters (liquid fuels); cords (firewood); metric tonnes (coal).

(8) Typical conversion factors are

1 terajoule = 278 megawatt hours (electricity)

1 terajoule = 26 kiloliters (NO. 2 fuel oil)

1 terajoule = 52 cords (dry wood)

1 terajoule = 37.6 metric tonnes (Yukon coal)

1 terajoule = 28.7 kiloliters (gasoline)

1 terajoule = 28 kiloliters (aviation gasoline)

1 terajoule = 24 kiloliters (residual fuel oil)

(9) Price inputs to the model are in nominal dollars per delivered terajoule. Conversion to constant 1980 dollars per effective terajoule occurs within the model.

(10) Explicit own price, cross price, and income elasticities of demand are used only in the residential and in the commercial/government sectors.[1/]

(11) Industrial demand is projected using fixed coefficient "input-output" style equations, with output and employment the key driver variables.

(12) The demand equations include multiplicative conservation factors with default values of 1.0. These are intended to allow the user to capture trends in conservation which are not handled implicitly by the price elasticity terms.

(13) Where a nonzero cross price elasticity is modelled, the demand effects (in effective terajoules) are equal and opposite for the two fuels. For example, if a rise in the price of fuel oil relative to wood causes a drop in the demand for fuel oil, it causes an equal magnitude increase in the demand for wood (ceteris paribus).

1/ The default values of these elasticities (see the TSP program below), were drawn from two surveys of the literature and represent rough averages of the values found in the studies surveyed. The two surveys were: (a) Bohi, D.R., Analyzing Demand Behavior, A Study of Energy Elasticities, (Resources For The Future, Johns Hopkins Press, Baltimore, Maryland) 1981; and (b) Taylor, L.D., "The Demand For Electricity, A Survey" in The Bell Journal of Economics, Spring 1975, pp. 74-110.

With these points and the following definitions in hand, the listing of the TSP program should be self-explanatory.

DEFINITION OF VARIABLES
- ENERGY MODEL -

MNEMONIC	DEFINITION
CFAG	Conversion factor, aviation gas, terajoules→units
CFAI	Conservation factor, aircraft
CFAU	Conservation factor, automobiles
CFBF	Conversion factor, fuel for process heat, terajoules→units
CFBU	Conservation factor, busses
CFCO	Conversion factor, coal, terajoules→units
CFDF	Conversion factor, diesel fuel, terajoules→units
CFEL	Conversion factor, electricity, terajoules→units
CFESC	Conservation factor, commercial electricity
CFESCA	Conservation factor, electricity, Cyprus Anvil
CFESOI	Conservation factor, electricity, "other" industrial
CFESPE	Conservation factor, electricity, placer mining & exploration
CFESR	Conservation factor, electricity, residential
CFESUK	Conservation factor, electricity, United Keno Hill
CFFO	Conversion factor, heating fuel oil, terajoules→units
CFGA	Conversion factor, industrial liquid fuels, terajoules→units
CFGAS	Conversion factor, motor gasoline, terajoules→units
CFHCC	Conservation factor, heating-cooling, commercial
CFHCCA	Conservation factor, heating-cooling, Cyprus Anvil
CFHCCN	Conservation factor, heating-cooling, construction

MNEMONIC	DEFINITION
CFHCOI	Conservation factor, heating-cooling, "other" industrial
CFHCPE	Conservation factor, heating-cooling, placer mining & exploration
CFHCR	Conservation factor, heating-cooling, residential
CFHCUK	Conservation factor, heating-cooling, United Keno Hill
CFLFCA	Conservation factor, liquid fuels, Cyprus Anvil
CFLFCN	Conservation factor, liquid fuels, construction
CFLFOI	Conservation factor, liquid fuels, "other" industrial
CFLFPE	Conservation factor, liquid fuels, placer mining & exploration
CFLFUK	Conservation factor, liquid fuels, United Keno Hill
CFPHHCA	Conservation factor, high temperature process heat, Cyprus Anvil
CFPHHPE	Conservation factor, high temperature process heat, placer mining and exploration
CFPHHUK	Conservation factor, high temperature process heat, United Keno Hill
CFPHLCA	Conservation factor, low temperature process heat, Cyprus Anvil
CFPHLPE	Conservation factor, low temperature process heat, placer mining & exploration
CFPHLUK	Conservation factor, low temperature process heat, United Keno Hill
CFRA	Conservation factor, railroad
CFTR	Conservation factor, trucks

MNEMONICS	DEFINITION
CFWD	Conversion factor, wood, terajoules→units
CGF	Exogenous growth factor, commercial electrification
COSTBFI	Cost of fuel for process heat, industrial sector
COSTELC	Cost of electricity, commercial sector
COSTELR	Cost of electricity, residential sector
COSTELI	Cost of electricity, industrial sector
COSTFOC	Cost of fuel oil, commercial sector
COSTFOI	Cost of fuel oil, industrial sector
COSTFOR	Cost of fuel oil, residential sector
COSTGAI	Cost of liquid fuels, industrial sector
COSTWDR	Cost of wood, residential sector
CPI80	Yukon consumer price index, 1980 base year (=1.000)
CPIYK	Yukon consumer price index, (1976 = 1.000)
CSTLFAI	Cost of liquid fuel, air transportation
CSTLFAU	Cost of liquid fuel, automobiles
CSTLFBU	Cost of liquid fuel, busses
CSTLFRA	Cost of liquid fuel, railroad
CSTLFTR	Cost of liquid fuel, trucks
DCWDHCR	Demand, wood, heating-cooling, residential, delivered units
DDJLFAI	Demand, liquid fuels, aircraft, delivered terajoules
DDJLFAU	Demand, liquid fuels, automobiles, delivered terajoules
DDJLFBU	Demand, liquid fuels, busses, delivered terajoules
DDJLFRA	Demand, liquid fuels, railroad, delivered terajoules
DDJLFTR	Demand, liquid fuels, trucks, delivered terajoules
DGAI	Demand, liquid fuels, aircraft, delivered units

MNEMONIC	DEFINITION
DGAU	Demand, liquid fuels, automobiles, delivered units
DGBFI	Demand, fuel for process heat, industrial, delivered units
DGBU	Demand, liquid fuel, busses, delivered units
DGFOHCC	Demand, fuel oil, heating-cooling, commercial, delivered units
DGFOHCI	Demand, fuel oil, heating-cooling, industrial, delivered units
DGFOHCR	Demand, fuel oil, heating-cooling, residential, delivered units
DGLFI	Demand, liquid fuel, industrial, delivered units
DGRA	Demand, liquid fuel, railroad, delivered units
DGTR	Demand, liquid fuel, trucks, delivered units
DJELHCR	Demand, electricity for heating-cooling, residential, effective terajoules
DJESC	Demand, electricity, commercial, effective terajoules
DJESCA	Demand, electricity, Cyprus Anvil, effective terajoules
DJESI	Demand, electricity, industrial, effective terajoules
DJESOI	Demand, electricity, "other" industrial, effective terajoules
DJESPE	Demand, electricity, placer mining & exploration, effective terajoules
DJESR	Demand, electricity, residential, effective terajoules
DJESUK	Demand, electricity, United Keno Hill, effective terajoules

MNEMONIC	DEFINITION
DJFOHCC	Demand, fuel oil, heating-cooling, commercial, effective terajoules
DJFOHCR	Demand, fuel oil, heating-cooling, residential, effective terajoules
DJHCGA	Demand, heating-cooling energy, Cyprus Anvil, effective terajoules
DJHCCN	Demand, heating-cooling energy, construction, effective terajoules
DJHCI	Demand, heating-cooling energy, industrial, effective terajoules
DJHCOI	Demand, heating-cooling energy, "other" industrial, effective terajoules
DJHCPE	Demand, heating-cooling energy, placer mining & exploration, effective terajoules
DJHCUK	Demand, heating-cooling energy, United Keno Hill, effective terajoules
DJLFCA	Demand, liquid fuels, Cyprus Anvil, effective terajoules
DJLFCN	Demand, liquid fuels, construction, effective terajoules
DJLFI	Demand, liquid fuels, industrial, effective terajoules
DJLFOI	Demand, liquid fuels, "other" industrial, effective terajoules
DJLFPE	Demand, liquid fuels, placer mining & exploration, effective terajoules

MNEMONIC	DEFINITION
DJLFUK	Demand, liquid fuels, United Keno Hill, effective terajoules
DJPHHCA	Demand, energy for high temperature process heat, Cyprus Anvil, effective terajoules
DJPHHI	Demand, energy for high temperature process heat, industrial, effective terajoules
DJPHHPE	Demand, energy for high temperature process heat, placer mining & exploration, effective terajoules
DJPHHUK	Demand, energy for high temperature process heat, United Keno Hill, effective terajoules
DJPHLCA	Demand, energy for low temperature process heat, Cyprus Anvil, effective terajoules
DJPHLHI	Demand, energy for low temperature process heat, industrial, effective terajoules
DJPHLPE	Demand, energy for low temperature process heat, placer mining & exploration, effective terajoules
DJPHLUK	Demand, energy for low temperature process heat, United Keno Hill, effective terajoules
DJTOTCA	Total energy demand, Cyprus Anvil, effective terajoules
DJTOTCN	Total energy demand, construction, effective terajoules
DJTOTI	Total energy demand, industrial, effective terajoules
DJTOTOI	Total energy demand, "other" industrial, effective terajoules
DJTOTPE	Total energy demand, placer mining & exploration, effective terajoules

MNEMONIC	DEFINITION
DJTOTUK	Total energy demand, United Keno Hill, effective terajoules
DJWDHCR	Demand, wood, heating-cooling, residential, effective terajoules
DKELC	Demand, electricity, commercial, delivered units
DKELR	Demand, electricity, residential, delivered units
DKESI	Demand, electricity, industrial, delivered units
DTCOI	Demand, coal, industrial, delivered units
ECOMYK	Employment, "commercial" sector, sum of services, communications-utilities, and government
EEPESC	Own price elasticity, commercial demand for electricity for electricity specific uses
EEPHCR	Cross price elasticity, residential demand for fuel oil with respect to relative electricity prices
EFBFI	Efficiency factor, process heat delivery systems, industrial
EFCOI	Efficiency factor, coal burners, industrial
EFFO	Efficiency factor, residential and commercial fuel oil heating units
EFFOI	Efficiency factor, industrial fuel oil heating units
EFGAI	Efficiency factor, liquid fuel burners, industrial
EFOPHCC	Own price elasticity, fuel oil, commercial heating-cooling
EFWD	Efficiency factor, commercial and residential sector, wood burning stoves
EPESR	Own price elasticity, residential electricity demand

MNEMONIC	DEFINITION
EWPHCR	Cross price elasticity, residential demand for fuel oil with respect to relative wood price
EYESR	Income elasticity of demand for residential electricity
EYHCR	Income elasticity of demand for fuel oil, residential heating-cooling
KMAU	Mean kilometers driven per vehicle, per year, automobiles
KMBU	Mean kilometers driven per vehicle, per year, busses
KMTR	Mean kilometers driven per vehicle, per year, trucks
LITKMAU	Mean liters of fuel consumed per kilometer, automobiles
LITKMBU	Mean liters of fuel consumed per kilometer, busses
LITKMTR	Mean liters of fuel consumed per kilometer, trucks
P1CA,...P5CA	Base year demand/employment, demand/output ratios, Cyprus Anvil
P1UK,...,P5UK	Base year demand/employment, demand/output ratios, United Keno Hill
P1CN, P2CN	Base year demand/employment ratios, construction
P1OI,...,P3OI	Base year demand/employment ratios, "other" industrial
P1PE,...,P5PE	Base year demand/employment ratios, placer mining & exploration
PBFI	Price per delivered terajole, liquid fuels for process heat
PBFI8Ø	PBFI in constant 198Ø dollars, per effective terajoule

MNEMONIC	DEFINITION
PDEL8Ø	Percent change in PFOEL8Ø
PDWD8Ø	Percent change in PFOWD8Ø
PDYK8Ø	Percent change in YDPC8Ø
PELC	Mean price of commercial electricity per delivered terajoule
PELC8Ø	PELC in constant 198Ø dollars, per effective terajoule
PELI	Mean price of industrial electricity per delivered terajoule
PELI8Ø	PELI in constant 198Ø dollars, per effective terajoule
PELR	Mean price of residential electricity per delivered terajoule
PELR8Ø	PELR in constant 198Ø dollars, per effective terajoule
PFOC	Mean price of fuel oil for heating, commercial, per delivered terajoule
PFOC8Ø	PFOC in constant 1980 dollars, per effective terajoule
PFOEL8Ø	Efficiency adjusted price of fuel oil relative to electricity, residential
PFOI	Mean price of fuel oil for heating, industrial, per delivered terajoule
PFIO8Ø	PFOI in constant 198Ø dollars, per effective terajoule
PFOR	Mean price of fuel oil for heating, residential, per delivered terajoule

MNEMONIC	DEFINITION
PFOR8Ø	PFOR in constant 198Ø dollars, per effective terajoule
PFOWD8Ø	Efficiency adjusted price of fuel oil relative to wood, residential
PGAI	Mean price of liquid fuels, industrial, per delivered terajoule
PGAI8Ø	PGAI in constant 198Ø dollars, per effective terajoule
PLFAI	Mean price of liquid fuel for aircraft, per delivered terajoule
PLFAI8Ø	PLFAI in constant 198Ø dollars, per effective terajoule
PLFAU	Mean price of liquid fuel for automobiles, per delivered terajoule
PLFAU8Ø	PLFAU in constant 198Ø dollars, per effective terajoule
PLFBU	Mean price of liquid fuel for busses, per delivered terajoule
PLFBU8Ø	PLFBU in constant 198Ø dollars, per effective terajoule
PLFRA	Mean price of liquid fuel for railroad, per delivered terajoule
PLFRA8Ø	PLFRA in constant 198Ø dollars, per effective terajoule
PLFTR	Mean price of liquid fuel for trucks, per delivered terajoule

MNEMONIC	DEFINITION
PLFTR8Ø	PLFTR in constant 198Ø dollars, per effective terajoule
PWDR	Mean price of firewood, per delivered terajoule
PWDR8Ø	PWDR in constant 198Ø dollars, per effective terajoule
REGAU	Number of registered automobiles
REGBU	Number of registered busses
REGTR	Number of registered trucks
SQMCOM	Square meters of commercial floor space

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FILE: ENMOD     DATA      A1  VM/SP CMS (PUT810E+) - 02/13/83

NAME GGRANT 'YUKON ENERGY DEMAND MODEL';
?****WARNING**** INDUSTRIAL "TOTALS" ARE NOT VALID INDEX;
?NUMBERS.THEY WILL BE VALID ONLY IF COMPONENTS ARE WEIGHTED;'
?OR IF ACTUAL HISTORICAL CONSUMPTION DATA IS LOADED IN****
REPL;
SMPL 4 5;LOAD;
SMPL 5 32; ?1978 IS THE BASE YEAR (SMPL 4);
FRML PELRQ PELR=(.02+CPI80/CPI80(-1))*PELR(-1);
FRML PFORQ PFOR=(.02+CPI80/CPI80(-1))*PFOR(-1);
FRML PWDRQ PWDR=(.02+CPI80/CPI80(-1))*PWDR(-1);
FRML PFOCQ PFOC=(.02+CPI80/CPI80(-1))*PFOC(-1);
FRML PELCQ PELC=(.02+CPI80/CPI80(-1))*PELC(-1);
FRML PFOIQ PFOI=(.02+CPI80/CPI80(-1))*PFOI(-1);
FRML PBFIQ PBFI=(.02+CPI80/CPI80(-1))*PBFI(-1);
FRML PGAIQ PGAI=(.02+CPI80/CPI80(-1))*PGAI(-1);
FRML PELIQ PELI=(.02+CPI80/CPI80(-1))*PELI(-1);
FRML KMAUQ KMAU=1*KMAU(-1);
FRML KMBUQ KMBU=1*KMBU(-1);
FRML KMTRQ KMTR=1*KMTR(-1);
FRML LITKMAUQ LITKMAU=1*LITKMAU(-1);
FRML LITKMBUQ LITKMBU=1*LITKMBU(-1);
FRML LITKMTRQ LITKMTR=1*LITKMTR(-1);
FRML REGAUQ REGAU=1*(NYK/NYK(-1))*REGAU(-1);
FRML REGTRQ REGTR=1*(NYK/NYK(-1))*REGTR(-1);
FRML REGBUQ REGBU=1*(NYK/NYK(-1))*REGBU(-1);
FRML PLFAIQ PLFAI=(.02+CPI80/CPI80(-1))*PLFAI(-1);
FRML PLFAUQ PLFAU=(.02+CPI80/CPI80(-1))*PLFAU(-1);
FRML PLFBUQ PLFBU=(.02+CPI80/CPI80(-1))*PLFBU(-1);
FRML PLFRAQ PLFRA=(.02+CPI80/CPI80(-1))*PLFRA(-1);
FRML PLFTRQ PLFTR=(.02+CPI80/CPI80(-1))*PLFTR(-1);
FRML CPI80Q CPI80=1*CPIYK/1.570; ?YUKON CPI 1980 BASE YEAR;
LIST E3,PELRQ,PFORQ,PWDRQ,PFOCQ,PELCQ,PFOIQ,PBFIQ,PGAIQ,
PELIQ,KMAUQ,KMBUQ,KMTRQ,LITKMAUQ,LITKMBUQ,LITKMTRQ,
REGAUQ,REGTRQ,REGBUQ,PLFAIQ,PLFAUQ,PLFBUQ,PLFRAQ,PLFTRQ,
CPI80Q;
LIST E4,PELR,PFOR,PWDR,PFOC,PELC,PFOI,PBFI,PGAI,
PELI,KMAU,KMBU,KMTR,LITKMAU,LITKMBU,LITKMTR,
REGAU,REGTR,REGBU,PLFAI,PLFAU,PLFBU,PLFRA,PLFTR,
CPI80;
COLECT E3,E4,PMOD;
SOLVE(TAG=S,DYNAM)PMOD;
GENR PELR=PELRS;
GENR PFOR=PFORS;
GENR PWDR=PWDRS;
GENR PFOC=PFOCS;
GENR CPI80=CPI80S;
GENR PELC=PELCS;
GENR PFOI=PFOIS;
GENR PBFI=PBFIS;
GENR PGAI=PGAIS;
GENR PELI=PELIS;
GENR KMAU=KMAUS;
GENR KMBU=KMBUS;
GENR KMTR=KMTRS;
GENR LITKMAU=LITKMAUS;
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GENR LITKMBU=LITKMBUS;
GENR LITKMTR=LITKMTRS;
GENR REGAU=REGAUS;
GENR REGTR=REGTRS;
GENR REGBU=REGBUS;
GENR PLFAI=PLFAIS;
GENR PLFAU=PLFAUS;
GENR PLFBU=PLFBUS;
GENR PLFRA=PLFRAS;
GENR PLFTR=PLFTRS;
?RESIDENTIAL;
?CONSTANTS---CONVERSION FACTORS;
CONST CFEL,.278;
CONST CFFO,.26;
CONST CFWD,.52;
?CONSTANTS---EFFICIENCY FACTORS;
CONST EFFO,.65;
CONST EFWD,.40;
?CONSTANTS---CONSERVATION FACTORS;
CONST CFHCR,1.0;
CONST CFESR,1.0;
?CONSTANTS---ELASTICITIES;
CONST EYESR,0.8;
CONST EPESR,-1.09;
CONST EYHCR,0.08;
CONST EWPHCR,-0.3;
CONST EEPHCR,0.0;
FRML DJFOHCRQ DJFOHCR=HHYK*(DJFOHCR(-1)/HHYK(-1))*CFHCR*
(1+EYHCR*PDYD80+EWPHCR*PDWD80+EEPHCR*PDEL80);
FRML PFOR80Q PFOR80=PFOR/(CPI80*EFFO);
FRML PWDR80Q PWDR80=PWDR/(CPI80*EFWD);
FRML PELR80Q PELR80=PELR/CPI80;
FRML PFOWD80Q PFOWD80=PFOR80/PWDR80;
FRML PFOEL80Q PFOEL80=PFOR80/PELR80;
FRML YDPC80Q YDPC80=YDYK/(NYK*CPI80)-(COSTFOR+COSTWDR+COSTELR)/NYK;
FRML PDYD80Q PDYD80=(YDPC80-YDPC80(-1))/(.5*(YDPC80+YDPC80(-1)));
FRML PDWD80Q PDWD80=(PFOWD80-PFOWD80(-1))/(.5*(PFOWD80+
PFOWD80(-1)));
FRML PDEL80Q PDEL80=(PFOEL80-PFOEL80(-1))/(.5*(PFOEL80+
PFOEL80(-1)));
FRML DJWDHCRQ DJWDHCR=HHYK*(DJWDHCR(-1)/HHYK(-1))*CFHCR*(1+EYHCR*
PDYD80)+HHYK*(DJFOHCR(-1)/HHYK(-1))*CFHCR*(-EWPHCR)*PDWD80;
FRML DJELHCRQ DJELHCR=HHYK*(DJELHCR(-1)/HHYK(-1))*CFHCR*(1+EYHCR*
PDYD80)+HHYK*(DJFOHCR(-1)/HHYK(-1))*CFHCR*(-EEPHCR)*PDEL80;
FRML DJESRQ DJESR=HHYK*(DJESR(-1)/HHYK(-1))*CFESR*(1+EYESR*
PDYD80)+EPESR*(PELR80-PELR80(-1))/(.5*(PELR80+PELR80(-1)));
FRML DGFOHCRQ DGFOHCR=DJFOHCR*CFFO/EFFO;
FRML DCWDHCRQ DCWDHCR=DJWDHCR/EFWD;
FRML DKELRQ DKELR=(DJESR+DJELHCR)*CFEL;
FRML COSTFORQ COSTFOR=DJFOHCR*PFOR80;
FRML COSTWDRQ COSTWDR=DJWDHCR*PWDR80;
FRML COSTELRQ COSTELR=(DJESR+DJELHCR)*PELR80;
?****COMMERCIAL****;
?CONSTANTS---CONSERVATION FACTORS;
CONST CFESC,1.0;
```

FILE: ENMOD DATA A1 VM/SP CMS (PUT8108+) - 02/13/83

```
CONST CFHCC,1.0;
?CONSTANT--EXOG GROWTH FACTOR,INCREASING ELECTRIFICATION;
CONST CGF,1.0;  ?CGF=1.0 IMPLIES NO EXTRA ELECTRIFICATION;
?CONSTANT---ELASTICITIES;
CONST EFOPHCC,0;
CONST EEPESC,-1.09;
FRML DJFOHCCQ DJFOHCC=SQMCOM*(DJFOHCC(-1)/SQMCOM(-1))*CFHCC*
(1+EFOPHCC*(PFOC80-PFOC80(-1))/PFOC80(-1));
FRML SQMCOMQ SQMCOM=(NBSVYK/NBSVYK(-1))*SQMCOM(-1);
FRML ECOMYKQ ECOMYK=ESVYK+ECUYK+EGFEDYK+EGLYK+EGTYK;
FRML DJESCQ DJESC=ECOMYK*(DJESC(-1)/ECOMYK(-1))*CFESC*
(1+EEPESC*(PELC80-PELC80(-1))/PELC80(-1))*CGF;
FRML PELC80Q PELC80=PELC/CPI80;
FRML PFOC80Q PFOC80=PFOC/(CPI80*EFFC);
FRML DGFOHCCQ DGFOHCC=DJFOHCC*CFFC/EFFC;
FRML DKELCQ DKELC=DJESC*CFEL;
FRML CGSTFOCQ CGSTFOC=DJFOHCC*PFOC80;
FRML COSTELCQ COSTELC=DJESC*PELC80;
?****INDUSTRIAL****;
?CONSTANTS BASE YEAR DEMAND/OUTPUT & DEMAND/EMPLOYMENT RATIOS;
CONST P1UK,1.224; ?INDEX VALUE;
CONST P2UK,1.224;?INDEX VALUE;
CONST P3UK,1.224; ?INDEX VALUE;
CONST P4UK,1.224; ?INDEX VALUE;
CONST P5UK,1.224; ?INDEX VALUE;
CONST P1CA,.0305; ?INDEX VALUE;
CONST P2CA,.0305; ?INDEX VALUE;
CONST P3CA,.0305; ?INDEX VALUE;
CONST P4CA,.0305; ?INDEX VALUE;
CONST P5CA,.0305; ?INDEX VALUE;
CONST P1PE,.196; ?INDEX VALUE;
CONST P2PE,.196; ?INDEX VALUE;
CONST P3PE,.196; ?INDEX VALUE;
CONST P4PE,.196; ?INDEX VALUE;
CONST P5PE,.196; ?INDEX VALUE;
CONST P1CN,.158; ?INDEX VALUE;
CONST P2CN,.158; ?INDEX VALUE;
CONST P1OI,.116; ?INDEX VALUE;
CONST P2OI,.116; ?INDEX VALUE;
CONST P3OI,.116; ?INDEX VALUE;
? CONSTANTS INDUSTRIAL CONSERVATION FACTORS;
CONST CFHCUK,1.0;
CONST CFPHLUK,1.0;
CONST CFPHHUK,1.0;
CONST CFLFUK,1.0;
CONST CFESUK,1.0;
CONST CFHCCA,1.0;
CONST CFPHLCA,1.0;
CONST CFPHCA,1.0;
CONST CFLFCA,1.0;
CONST CFESCA,1.0;
CONST CFHCPE,1.0;
CONST CFPHLPE,1.0;
CONST CFPHHPE,1.0;
CONST CFLFPE,1.0;
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FILE: ENMOD     DATA     A1  VM/SP CMS (PUT8108+) - 02/13/83

CONST CFESPE,1.0;
CONST CFHCCN,1.0;
CONST CFLFCN,1.0;
CONST CFHCOI,1.0;
CONST CFLFOI,1.0;
CONST CFESOI,1.0;
?CONSTANTS---CONVERSION FACTORS NOT SET ABOVE;
CONST CFCO,37.6;
CONST CFBF,24;
CONST CFGA,28.7;
?CONSTANTS---INDUSTRIAL EFFICIENCY FACTORS;
CONST EFFOI,.65;
CONST EFCOI,.55;
CONST EFBFI,.60;
CONST EFGAI,.65;
?UNITED KENO HILL;
FRML DJHCUKQ DJHCUK=QMIUKYK*P1UK*CFHCUK;
FRML DJPHLUKQ DJPHLUK=QMIUKYK*P2UK*CFPHLUK;
FRML DJPHHUKQ DJPHHUK=QMIUKYK*P3UK*CFPHHUK;
FRML DJLFUKQ DJLFUK=QMIUKYK*P4UK*CFLFUK;
FRML DJESUKQ DJESUK=QMIUKYK*P5UK*CFESUK;
FRML DJTOTUKQ DJTOTUK=DJHCUK+DJPHLUK+DJPHHUK+DJLFUK+DJESUK;
?CYPRUS ANVIL;
FRML DJHCCAQ DJHCCA=QMICAYK*P1CA*CFHCCA;
FRML DJPHLCAQ DJPHLCA=QMICAYK*P2CA*CFPHLCA;
FRML DJPHHCAQ DJPHHCA=QMICAYK*P3CA*CFPHCA;
FRML DJLFCAQ DJLFCA=QMICAYK*P4CA*CFLFCA;
FRML DJESCAQ DJESCA=QMICAYK*P5CA*CFESCA;
FRML DJTOTCAQ DJTOTCA=DJHCCA+DJPHLCA+DJPHHCA+DJLFCA+DJESCA;
?PLACER MINING AND EXPLORATION;
FRML DJHCPEQ DJHCPE=(EMIXYK+EMIPYK)*P1PE*CFHCPE;
FRML DJPHLPEQ DJPHLPE=(EMIXYK+EMIPYK)*P2PE*CFPHLPE;
FRML DJPHHPEQ DJPHHPE=(EMIXYK+EMIPYK)*P3PE*CFPHPPE;
FRML DJLFPEQ DJLFPE=(EMIXYK+EMIPYK)*P4PE*CFLFPE;
FRML DJESPEQ DJESPE=(EMIXYK+EMIPYK)*P5PE*CFESPE;
FRML DJTOTPEQ DJTOTPE=DJHCPE+DJPHLPE+DJPPHPE+DJLFPE+DJESPE;
?CONSTRUCTION;
FRML DJHCCNQ DJHCCN=ECYK*.5*P1CN*CFHCCN;
FRML DJLFCNQ DJLFCN=ECYK*.5*P2CN*CFLFCN;
FRML DJTOTCNQ DJTOTCN=DJHCCN+DJLFCN;
?OTHER INDUSTRIAL;
FRML DJHCOIQ DJHCOI=(ELUMYK+EOYK)*P1OI*CFHCOI;
FRML DJLFOIQ DJLFOI=(ELUMYK+EOYK)*P2OI*CFLFOI;
FRML DJESOIQ DJESOI=(ELUMYK+EOYK)*P3OI*CFESOI;
FRML DJTOTOIQ DJTOTOI=DJHCOI+DJLFOI+DJESOI;
?INDUSTRIAL SUMMARY TOTALS;
FRML DJTOTIQ DJTOTI=DJTOTUK+DJTOTCA+DJTOTPE+DJTOTCN+DJTOTOI;
FRML DJHCIQ DJHCI=DJHCUK+DJHCCA+DJHCPE+DJHCCN+DJHCOI;
FRML DJPHLIQ DJPHLI=DJPHLUK+DJPHLCA+DJPHLPE;
FRML DJPHHIQ DJPHHI=DJPHHUK+DJPHHCA+DJPHHPE;
FRML DJLFIQ DJLFI=DJLFUK+DJLFCA+DJLFPE+DJLFCN+DJLFOI;
FRML DJESIQ DJESI=DJESUK+DJESCA+DJESPE+DJESOI;
?INDUSTRIAL DEMAND TOTALS IN UNITS (KILOLITERS ETC);
FRML DGFOHCIQ DGFOHCI=DJHCI*CFFO/EFFOI;
FRML DTCOIQ DTCOI=.776*(DJPHLI*CFCO/EFCOI); ?.776 IS 1978 COAL/TOTAL;
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FILE: ENMOD     DATA      A1  VM/SP CMS (PUT8108+) - 02/13/83

FRML DGBFIQ DGBFI=.224*(DJPHLI*CFBF/EFBFI)+DJFHMI*CFBF/EFEFI;?SEE NOTES;
?NOTE: YT1 IN PREVIOUS LINES REFERS TO TABLE YT1 IN "NORTHERN ENERGY";
?NOTE: THE FACTOR .224 EQUALS 1-.776;
FRML DGLFIQ DGLFI=DJLFI*CFGA/EFGAI;
FRML DKESIQ DKESI=DJESI*CFEL;
?COSTS IN 1980 DOLLARS;
FRML COSTFOIQ COSTFOI=PFOI80*DGFOHCI;
FRML COSTBFIQ COSTBFI=PBFI80*DGBFI;
FRML COSTGAIQ COSTGAI=PGAI80*DGLFI;
FRML COSTELIQ COSTELI=PELI80*DKESI;
?PRICES PER EFFECTIVE TERAJOULE;
FRML PFOI80Q PFOI80=PFOI/(CPI80*EFFCI);
FRML PBFI80Q PBFI80=PBFI/(CPI80*EFBFI);
FRML PGAI80Q PGAI80=PGAI/(CPI80*EFGAI);
FRML PELI80Q PELI80=PELI/CPI80;
?TRANSPORTATION;
?CONSTANTS---CONSERVATION FACTORS;
CONST CFAI,1.0;
CONST CFAU,1.0;
CONST CFBU,1.0;
CONST CFRA,1.0;
CONST CFTR,1.0;
?CONSTANTS---CONVERSION FACTORS;
CONST CFAG,28;
CONST CFDF,26;
CONST CFGAS,28.7;
FRML DDJLFAIQ DDJLFAI=DDJLFAI(-1)*(NYK/NYK(-1))*CFAI;
FRML DDJLFRAQ DDJLFRA=DDJLFRA(-1)*((TCURNYK/TCURNYK(-1))*
.5+.5*(QMIUKYK+QMICAYK)/(QMIUKYK(-1)+QMICAYK(-1)))*CFRA;
FRML DDJLFAUQ DDJLFAU=DDJLFAU(-1)*(KMAU/KMAU(-1)+LITKMAU/
LITKMAU(-1)+REGAU/REGAU(-1)-2)*CFAU;
FRML DDJLFTRQ DDJLFTR=DDJLFTR(-1)*(KMTR/KMTR(-1)+LITKMTR/
LITKMTR(-1)+REGTR/REGTR(-1)-2)*CFTR;
FRML DDJLFBUQ DDJLFBU=DDJLFBU(-1)*(KMBU/KMBU(-1)+LITKMBU/
LITKMBU(-1)+REGBU/REGBU(-1)-2)*CFBU;
?TRANSPORTATION COSTS IN 1980 DOLLARS;
FRML CSTLFAIQ CSTLFAI=PLFAI80*DDJLFAI;
FRML CSTLFRAQ CSTLFRA=PLFRA80*DDJLFRA;
FRML CSTLFAUQ CSTLFAU=PLFAU80*DDJLFAU;
FRML CSTLFTRQ CSTLFTR=PLFTR80*DDJLFTR;
FRML CSTLFBUQ CSTLFBU=PLFBU80*DDJLFBU;
FRML PLFAI80Q PLFAI80=PLFAI/CPI80;
FRML PLFRA80Q PLFRA80=PLFRA/CPI80;
FRML PLFAU80Q PLFAU80=PLFAU/CPI80;
FRML PLFTR80Q PLFTR80=PLFTR/CPI80;
FRML PLFBU80Q PLFBU80=PLFBU/CPI80;
?TRANSPORTATION DEMAND IN UNITS;
FRML DGAIQ DGAI=DDJLFAI*CFAG;
FRML DGRAQ DGRA=DDJLFRA*CFDF;
FRML DGAUQ DGAU=DDJLFAU*CFGAS;
FRML DGTRQ DGTR=DDJLFTR*CFGAS;
FRML DGBUQ DGBU=DDJLFBU*CFGAS;
LIST E1.        DJFOHCRQ,PFOR80Q,PWCR80Q,PELR8CQ,PFOWD80Q,
PFOEL80Q,YDPC80Q,PDYC80Q,PDWD80Q,PDEL80Q,DJWDFCRQ,DJELHCRQ,
DJESRQ,DGFOHCRQ,DCWDHCRQ,DKELRQ,CCSTFORQ,CCSTWDRQ,COSTELRQ,
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FILE: ENMOD     DATA      A1  VM/SP CMS (PUT8108+) - 02/13/83

DJFOHCCG,SQMCGMQ,ECGMYKG,DJESCQ,PELC80G,PFOC8CG,DGFCHCCG,
DKELCG,CGSTFOCQ,COSTELCG,DJHCUKQ,DJFHLUKG,DJPHHUKQ,DJLFLKG,
DJESUKQ,DJTOTUKQ,DJHCCAG,DJPHLCAG,DJPHHCAG,DJLFCAG,DJESCAG,
DJTOTCAG,DJHCPEQ,DJPHLPEQ,DJPHHPEQ,DJLFPEQ,DJESPEQ,
DJTOTPEG,DJHCCNQ,DJLFCNG,DJTOTCNQ,CJHCGIG,DJLFGIG,DJESGIG,
DJTOTOIQ,DJTOTIQ,DJHCIQ,DJPHLIQ,DJPHHIQ,DJLFIG,CJESIQ,DGFOHCIQ,
DTCGIG,DGBFIG,DGLFIG,DKESIQ,CGSTFGIG,CGSTBFIG,CGSTGAIG,
COSTELIQ,PFGI80G,PBF180G,PGAI80Q,PELI80G,DDJLFAIQ,DDJLFRAG,
DDJLFAUQ,DDJLFTRQ,DDJLFBUQ,CSTLFAIG,
CSTLFRAG,CSTLFAUQ,CSTLFTRQ,CSTLFBUG,PLFAI80G,PLFRA80Q,
PLFAU80G,PLFTR80G,PLFBU80Q,DGAIQ,DGRAQ,DGAUG,DGTRG,DGBUG;
LIST E2,      DJFOHCR,PFOR80,PWDR80,PELR80,PFCWC80,
PFOEL80,YOPC80,PDYD80,PDWD80,PDEL80,DJWDHCR,DJELHCR,DJESR,
DGFCHCR,DCWDHCR,DKELR,CGSTFOR,COSTWDR,CGSTELR,DJFCHCC,
SQMCOM,ECGMYK,DJESC,PELC80,PFGC80,DGFCHCC,DKELC,CGSTFCC,
COSTELC,DJHCUK,DJPHLUK,DJPHHUK,DJLFUK,DJESUK,DJTOTUK,
DJHCCA,DJPHLCA,DJPHHCA,DJLFCA,DJESCA,DJTOTCA,DJHCPE,DJPHLPE,
DJPHHPE,DJLFPE,DJESPE,DJTOTPE,DJHCCN,DJLFCN,DJTOTCN,
DJHCOI,DJLFOI,DJESOI,DJTOTOI,DJTOTI,DJHCI,DJPHLI,DJPHHI,
DJLFI,DJESI,DGFOHCI,DTCOI,DGBFI,DGLFI,DKESI,CCSTFOI,
COSTBFI,CCSTGAI,COSTELI,PFOI80,PBFI80,PGAI80,PELI80,DDJLFAI,
DDJLFRA,DDJLFAU,DDJLFTR,DDJLFBU,CSTLFAI,
CSTLFRA,CSTLFAU,CSTLFTR,CSTLFBU,PLFAI80,PLFRA80,PLFAU80,
PLFTR80,PLFBU80,DGAI,DGRA,DGAU,DGTR,DGBU;
COLECT E1,E2,ENMODEL;
SOLVE(DYNAM)ENMODEL;
STOP;END;
?BASE YEAR DATA FOR 1978,1979.;
LOAD PFGR80;
199.02 199.02;
LOAD PWDR80;
323.4 323.4;
LOAD PELR80;
129.4 129.4;
LOAD PFCWD80;
.615 .615;
LOAD PFOEL80;
1.538 1.538;
LOAD YOPC80;
3.485 3.485;
LOAD PDYD80;
0 0;? DUMMY. NO NEED TO CORRECT;
LOAD PDWD80;
0 0; ?DUMMY. NO NEED TO CORRECT;
LOAD PDEL80;
0 0; ?DUMMY. NO NEED TO CORRECT;
LOAD DGFOHCR;
18460 18460;
LOAD DCWDHCR;
12480 12480;
LOAD DKELR;
86180 86180;
LOAD COSTFOR;
91847.7 91847.7; ?INDEX VALUE;
LOAD COSTWDR;
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```
31046.4 31046.4; ?INDEX VALUE;
LOAD CGSTELH;
16822 16822; ?INDEX VALUE;
LOAD ECGMYK;
5719 5719;
LOAD PELC80;
129.4 129.4; ?INDEX VALUES;
LOAD PFCC80;
199.02 199.02;?INDEX VALUES;
LOAD DGFOMCC;
33080 33080; ?INDEX VALUES;
LOAD DKELC;
85902 85902; ?INDEX VALUES;
LOAD CGSTFOC;
164589.5 164589.5; ?INDEX VALUES;
LOAD CGSTELC;
39984.6 39984.6; ?INDEX VALUES;
LOAD PLFAI80;
129.4 129.4; ?INDEX VALUES;
LOAD PLFRA80;
129.4 129.4; ?INDEX VALUES;
LOAD PLFAU80;
129.4 129.4; ?INDEX VALUES;
LOAD PLFTR80;
129.4 129.4; ?INDEX VALUES;
LOAD PLFBU80;
129.4 129.4; ?INDEX VALUES;
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LOAD CSTLFRA;
12940 12940; ?INDEX VALUES;
LOAD CSTLFAU;
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LOAD CSTLFTR;
12940 12940; ?INDEX VALUES;
LOAD CSTLFBU;
12940 12940; ?INDEX VALUES;
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LOAD DGRA;
2600 2600; ?INDEX VALUES;
LOAD DGAU;
2870 2870; ?INDEX VALUES;
LOAD DGTR;
2870 2870; ?INDEX VALUES;
LOAD DGBU;
2870 2870; ?INDEX VALUES;
LOAD DJELHCR;
180 180;
LOAD DJESR;
130.130;
LOAD DJFOHCR;
461.5 461.5;
LOAD DJWDHCR;
96 96;
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```
FILE: ENMOD     DATA      A1  VM/SP CMS (PUT8108+) - 02/13/83

LOAD CP180;
.773 .857;
LOAD PELR;
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LOAD PFOR;
100 100; ?INDEX VALUES;
LOAD PWDR;
100 100; ?INDEX VALUES;
LOAD DJESC;
309 309;
LOAD DJFOHCC;
827 827;
LOAD PFOC;
100 100; ?INDEX VALUES;
LOAD PELC;
100 100; ?INDEX VALUES;
LOAD SOMCOM;
404.3 404.3;
LOAD DJHCUK;
100 100; ?INDEX VALUES;
LOAD DJPHLUK;
100 100; ?INDEX VALUES;
LOAD DJPHHUK;
100 100; ?INDEX VALUES;
LOAD DJLFUK;
100 100; ?INDEX VALUES;
LOAD DJESUK;
100 100; ?INDEX VALUES;
LOAD DJHCCA;
100 100;?INDEX VALUES;
LOAD DJPHLCA;
100 100; ?INDEX VALUES;
LOAD DJPHHCA;
100 100; ?INDEX VALUES;
LOAD DJLFCA;
100 100; ?INDEX VALUES;
LOAD DJESCA;
100 100; ?INDEX VALUES;
LOAD DJHCPE;
100 100; ?INDEX VALUES;
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100 100; ?INDEX VALUES;
LOAD DJPHHPE;
100 100; ?INDEX VALUES;
LOAD DJLFPE;
100 100; ? INDEX VALUES;
LOAD DJESPE;
100 100; ?INDEX VALUES;
LOAD DJHCCN;
100 100; ?INDEX VALUES;
LOAD DJLFCN;
100 100; ?INDEX VALUES;
LOAD DJHCOI;
100 100; ?INDEX VALUES;
LOAD DJLFOI;
```

```
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LOAD DJESCI;
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LOAD DDJLFAU;
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LOAD PBFI;
100 100; ?INDEX VALUES;
LOAD PGAI;
100 100; ?INDEX VALUES;
LOAD PELI;
100 100; ?INDEX VALUES;
LOAD KMAU;
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LOAD KMBU;
100 100; ?INDEX VALUES;
LOAD KMTR;
100 100; ?INDEX VALUES;
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100 100; ?INDEX VALUES;
LOAD LITKMBU;
100 100; ?INDEX VALUES;
LOAD LITKMTR;
100 100; ?INDEX VALUES;
LOAD REGAU;
100 100; ?INDEX VALUES;
LOAD REGBU;
100 100; ?INDEX VALUES;
LOAD REGTR;
100 100; ?INDEX VALUES;
LOAD PLFAI;
100 100; ?INDEX VALUES;
LOAD PLFAU;
100 100; ?INDEX VALUES;
LOAD PLFBU;
100 100; ?INDEX VALUES;
LOAD PLFRA;
100 100; ?INDEX VALUES;
LOAD PLFTR;
100 100; ?INDEX VALUES;
LOAD DGFOHCI;
4000 4000;?INDEX VALUES;
LOAD DTCOI;
5305 5305; ?INDEX VALUES;
LOAD DGLFI;
4415 4415; ?INDEX VALUES;
```

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FILE: ENMCD     DATA     A1  VM/SP CMS (PUTE1C8+) - 02/13/83

LOAD OKES1;
27800 27800; ?INDEX VALUES;
LOAD COSTFO1;
10000 10000; ?INDEX VALUES;
LOAD COSTGA1;
10000 10000; ?INDEX VALUES;
LOAD COSTEL1;
10000 10000; ?INDEX VALUES;
LOAD PFC180;
199.02 199.02; ?INDEX VALUES;
LOAD PBF180;
215.61 215.61; ?INDEX VALUES;
LOAD PGA180;
199.02 199.02; ?INDEX VALUES;
LOAD PEL180;
129.37 129.37; ?INDEX VALUES;
?EXOGENOUS VARIABLES FROM NEWYEN.UPDATE FROM DESIRED NEWYEN SIM.;
SMPL 4 32; ?1978 TO 2006;
LOAD TOURNYK;
362905 362174 340440 386772 388399 386873 386229 383483
381651 379744 377773 375747 373675 371562 369515 367240
365040 362820 360584 358335 356076 353809 351537 349262
346986 344710 342437 340167 337902 ;
LOAD HHYK;
6782 6925 6925 6925 6925 6925 6925 6925 6925 6925 6925 6925
6925 6925 6925 6925 6925 6925 6925 6925 7100 7200 7300 7400
7500 7600 7700 7800 7900;
LOAD YDYK;
170793 182268 204754 235104 245245 269667 289523 314067 338955
365967 394760 425630 458686 494056 532045 572715 616331
663103 713281 767124 824920 886971 953612 1025200
1102120 1184790 1273660 1369230 1472020;
LOAD NYK;
23306 22921 22972 22922 22944 23113 23236 23384 23531 23684 23842
24006 24174 24348 24527 24711 24902 25098 25300 25508 25722
25943 26171 26405 26646 26894 27150 27414 27684;
LOAD CPIYK;
1.213 1.346 1.570 1.823 1.839 1.951 2.070 2.196 2.330 2.472
2.622 2.782 2.951 3.131 3.322 3.524 3.738 3.966 4.208
4.464 4.736 5.024 5.330 5.655 5.999 6.364 6.752 7.163
7.599;
LOAD NBSVYK;
617 620 620 630 640 650 660 670 680 690 700 710 720 730 740
750 760 770 780 790 800 810 820 830 840 850 860 870 880;
LOAD ELUMYK;
28 36 50 26 35 35 35 35 35 35 35 35 35 35 35 35 35 35 35
35 35 35 35 35 35 35 35 35 35 35;
LOAD ESVYK;
2081 2100 2130 2160 2190 2220 2250 2280 2310 2340 2370 2400
2430 2460 2490 2520 2550 2580 2310 2340 2370 2400 2430
2460 2490 2520 2550 2580 2610;
LOAD ECUYK;
346 346 388 392 394 401 408 417 426 435 444 454 464 475 486
497 509 520 533 545 558 572 585 599 614 629 645 660 677;
LOAD EGFEDYK;
```

```
FILE: ENMOD     DATA      A1   VM/SP CMS (PUT8108+) - 02/13/83

1373 1390 1410 1430 1450 1470 1490 1510 1530 1550 1570 1590
1610 1630 1650 1670 1690 1710 1730 1750 1770 1790 1810
1830 1850 1870 1890 1910 1930;
LOAD EGLYK;
164 172 175 157 155 161 165 169 174 178 182 186 190 194 199
203 207 211 215 219 223 227 231 235 239 244 248 252 257;
LOAD EGTYK;
1755 1730 1714 1574 1573 1621 1662 1708 1754 1800 1846 1893
1939 1986 2033 2079 2126 2173 2221 2268 2315 2363 2411
2460 2509 2558 2607 2656 2709 ;
?USE OF 1 INSTEAD OF 0 IN MINE OUTPUT PREVENTS DIV. BY ZERO;
LOAD GNIUKYK;
81.722 81.722 81.722 81.722 81.722 81.722 81.722
81.722 81.722 81.722  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1;
LOAD GNICAYK;
3280 3280 3280 3280 3280 3280 3280 3280 3280 3280 3280
1 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1;
LOAD EMIPYK;
128 191 369 243 249 254 259 265 270 276 282 288 294 300
306 313 319 326 333 339 346 353 361 368 376 383 391
399 408;
LOAD EMIXYK;
300 318 371 420 358 361 363 365 368 370 373 375 378 381
384 386 389 392 395 398 401 404 408 411 414 417 421
424 428 ;
LOAD ECYK;
801 631 494 538 541 582 578 589 554 600 604 610 614
618 622 626 629 632 636 639 642 646 649 652 656
659 663 666 670;
LOAD EOYK;
689 824 832 841 849 858 866 875 884 892 901 910 919
929 938 947 957 966 976 986 996 1006 1016 1026
1036 1046 1056 1066 1076;
?THE FOLLOWING "TOTALS" ARE NOT USEABLE UNTIL ACTUAL DATA IS LOADED?
SMPL 4 5;
LOAD DJTOTUK;
100 100;
LOAD DJTOTCA;
100 100;
LOAD DJTOTPE;
100 100;
LOAD DJTOTCN;
100 100;
LOAD DJTOTOI;
100 100;
LOAD DJTOTI;
100 100;
LOAD DJHCI;
100 100;
LOAD DJPHLI;
100 100;
LOAD DJPHHI;
100 100;
LOAD DJLFI;
100 100;
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FILE: ENMCD DATA A1 VM/SP CMS (PUTBICE+) - 02/13/83

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LOAD DJES1;
100 100;
LOAD CCSTBF1;
100 100;
LOAD DGBF1;
100 100;
END;
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APPENDIX A: CONSTRUCTED VARIABLES

The construction of several variables has been documented above. These include bank deposits (BDEPYK), housing completions (HCOMPYK), construction employment (ECYK), the metals price index (JMETYK), mining revenue (RMICAYK, RMIYKYK), consumption (CDYK, CNDYK), the Yukon consumer price index (CPIYK), federal income tax collections (RFPITYK), the approximate number of self-employed persons (NSEYK), average earnings per job by industry (AECYK,...), and net migration (NMIGYK). In some cases these series were created by identity from existing Yukon data, in others less direct estimation methods were used. This appendix relates the methods used in estimating the remainder of the variables and/or observations used in NEWYEM that were not directly available to the model builder: mining employment; employment in services; transportation; communications-utilities; "other tourist expenditure; and the components of personal income (post-1978). The methods discussed here pertain to the construction of historical datapoints.

CONSTRUCTED MINING EMPLOYMENT

The data series giving total mining employment was available annually for the period 1967 to 1981. Except for recent observations, it is not clear how this series divided into components. Estimates of annual "employment" (definition

not clear) for the Yukon's major mines have been published by DIAND.[1/] Because the sum of DIAND employment estimates for major mines alone exceeded the published mining total (leaving no room for placer mining and exploration), it was assumed that the DIAND estimates gave peak annual employment rather than annual average employment. After some trial and error, annual average employment in the major mines was defined to equal .75 times the DIAND estimates.

Estimates of employment in placer mining were made by multiplying the time series RGPYK (royalties paid on placer gold) by the coefficient .004968. This coefficient is the mean of the 1978 and 1980 ratios of employment to placer gold produced estimated in the two "Miller" reports.[2/]

Employment in mining exploration was then defined by residual to equal total mining employment less placer mining employment, less employment in "major" mines. The data are included in Appendix C.

1/ Yukon Mines and Mineral Activities, annual 1971-1982. Mines covered were Cyprus Anvil, United Keno Hill, Whitehorse Copper, Casiar Asbestos (Porcupine orebody), Tantalus Butte Coal Company, Mount Nansen Mines (Huestis), and Hudson-Yukon's Wellgreen Mine.

2/ "Impact On The Yukon Economy Of The Gold Placer Mining Industry," prepared for the Klondike Gold Placer Miners Association, by M.E. Miller and Associates, Ltd., February 1979 and February 1981.

CONSTRUCTED EMPLOYMENT - SUPPORT INDUSTRIES AND "OTHER"

We were unable to obtain data for support sector employment for the years prior to 1977. The "support" industries in question are transportation, services and communications-utilities. As a result, the residual category "other" was also unavailable prior to 1977. To estimate these employment series for the period 1972 to 1976, the following multi-step approach was implemented.

Step 1: For the period 1972 to 1981, subtract from total employment (a) mining, (b) government, and (c) construction. This gives the sum of support sector employment and "other" employment.

Step 2: For the years 1977 to 1981, calculate the mean ratio of support sector employment to the result of Step 1 (answer = .926).

Step 3: For the years 1972 to 1976, multiply the Step 1 result by .926 (the Step 2 result). This yields total support sector employment for 1972 to 1976.

Step 4: For the years 1977 to 1981, calculate (a) the ratio of services employment to total support sector employment, (b) the ratio of transportation employment to total support sector employment, and (c) the ratio of communications-utilities employment to total support sector employment. These ratios sum to 1.0 and have 1977 to 1981 means of .644, .198, and .158, respectively.

Step 5: For the years 1972 to 1976, multiply total support sector employment from Step 3 by the three ratios derived in Step 4.

The time series derived in this manner were:

	Services	Transportation	Communications-Utilities	Total Support
1972	1940	596	476	3012
1973	1789	550	439	2778
1974	1660	510	407	2577
1975	1804	555	443	2802
1976	1933	594	474	3001
1977	1885	712	332	2929
1978	2081	741	346	3168
1979	2273	677	468	3418
1980	2499	645	492	3636
1981	3190	798	497	4485

Upon inspection it was apparent that a discontinuity existed between the pre-1977 and post-1977 portions of the sample.

Services sector and communications-utilities employment declines in 1977 while transportation shows a 120 percent gain. Furthermore, although not shown here, total employment rose throughout the 1972 to 1981 period, rising 3.8 percent in 1977, alone. In the face of this discontinuity (part of which

may be due to problems with the published total employment series), the support sector employment series were judgementally smoothed to ease the 1976 to 1977 discontinuity. The results are given in Appendix C (ETYK, ESVYK, ECUYK).

The series giving "other" employment was defined to equal ETOTYK-EMIYK-ECYK-EGFEDYK-EGTYK-EGLYK-ETYK-ESVYK-ECUYK. This series includes forestry employment. Over the forecast period "other" employment excludes forestry employment (ELUMYK).

CONSTRUCTED TOURIST EXPENDITURE, 1978-1980

The data series on tourist expenditure published in Yukon Economic Indicators[1/] concludes with 1978 data. Data for 1981 are available in Yukon Tourism Industry Highlights 1981.[2/] The published 1978 observation is an "estimate" made by the Department.

For 1978, 1979, and 1980 the values of TOURXYK given in Appendix C were constructed as follows.

Step 1: Calculate the 1977 to 1981 change in real tourist expenditure (= $2,884,000).

Step 2: Calculate the 1977 to 1981 change in the number of tourists (= 86,618).

1/ Yukon Department of Economic Development & Intergovernmental Relations.
2/ Ibid. April 1982, p. 39.

Step 3: For 1977-1978, 1978-1979, 1979-1980, 1980-1981 calculate the ratio of the annual change in the number of tourists to the result of Step 2. (= .7244, -.0084, -.2509, .5349).

Step 4: Estimate the year-to-year changes in real tourist expenditure by multiplying the result of Step 1 by each of the ratios from Step 3.

Step 5: Define the level of real tourist expenditure as the previous year's level plus the appropriate annual change from Step 4.

Step 6: Inflate the result of Step 5 to nominal dollars using CPIYK.

The resultant observations are included in Appendix C as the 1978, 1979, and 1980 observations on TOURXYK. The method used constrains the 1981 estimate to equal the published estimate cited above.

COMPONENTS OF PERSONAL INCOME, 1979-1981

With one exception the components of personal income were estimated for the 1979 to 1981 period by solving their respective NEWYEM equations. The exception was transfers to persons (VPYK). Estimates of personal income and its components were made for this period because they were not as yet available from DIAND or Statistics Canada, and because the extra observations on disposable income were needed in

order to estimate the rest of the model's equations. Three observations can be precious.

Over the 1979 to 1971 period, transfers to persons were set equal to .06063 times personal income. The equation used to estimate personal income for this time period was

```
YPYK = (WSYK+YUNYK+YTRADYK+YMILYK+YINVYK)/(1-.06063)
```

The 1979 to 1981 estimates are included under the respective mnemonics in Appendix C.

APPENDIX B

DEFINITION OF VARIABLES

NOTE: MNEMONICS ENDING IN "YK" DENOTE YUKON DATA

ENDOGENOUS VARIABLES
(Economic Model)

MNEMONIC	DESCRIPTION
AECYK	Ratio of payroll to employment, construction, thousands of dollars.
AEGFYK	Ratio of payroll to employment, federal government, thousands of dollars.
AEGLYK	Ratio of payroll to employment, local government, thousands of dollars.
AEGTYK	Ratio of payroll to employment, territorial government, thousands of dollars.
AEMIYK	Ratio of payroll to employment, mining, thousands of dollars.
AESVYK	Ratio of payroll to employment, service industries, thousands of dollars.
AETCUYK	Ratio of payroll to employment, transport-communications-utilities, thousands of dollars.
BYK	Number of live births.
BDEPYK	Total personal savings deposits, chartered banks, millions of dollars.
CYK	Total consumption expenditure, thousands of dollars.
CDYK	Consumption expenditure, durable goods, thousands of dollars.
CNDYK	Consumption expenditure, other than durables, thousands of dollars.
CPIYK	Consumer price index, 1976 = 1.000 1982 population weighted average of Whitehorse, Watson Lake, and Dawson City temporal price indices, annual average.
DYK	Deaths, total.
ECYK	Employment, construction.
ECUYK	Employment, communications-utilities.

MNEMONIC	DESCRIPTION
EGFEDYK	Employment, federal government.
EGLYK	Employment, local government.
EGTYK	Employment territorial government.
ELUMYK	Employment, forestry.
EMIYK	Employment, all mining.
EMICAYK	Employment, Cyprus Anvil.
EMIPYK	Employment, placer mining.
EMIUKYK	Employmebt, United Keno Hill.
EMIXYK	Employment, mining exploration.
ESVYK	Employment, service industries.
ETYK	Employment, transportation.
ETOTYK	Employment, total wage and salary.
GFYK	Federal government expenditure, total, thousands of dollars.
GFCYK	Federal government expenditure, total current, thousands of dollars.
GFOCYK	Federal government expenditure, "other" current, thousands of dollars.
GLYK	Local government expenditure, total, thousands of dollars.
GLCYK	Local government expenditure, total current, thousands of dollars.
GLOCYK	Local government expenditure, "other" current, thousands of dollars.
GOLDPYK	Quantity of placer gold produced, troy ounces (1 troy ounce = 31.103 grams).
GTYK	Territorial government expenditure, total, thousands of dollars.
GTCYK	Territorial government expenditure, total current, thousands of dollars.
GTOCYK	Territorial government expenditure, "other" current, thousands of dollars.
HADYK	Stock of occupied housing units, apartments, and duplexes.

MNEMONIC	DESCRIPTION
HHYK	Stock of occupied housing units, total (Note: also equals number of households).
HOYK	Stock of occupied housing units, "other."
HSAYK	Stock of occupied housing units, single attached.
HSDYK	Stock of occupied housing units, single detached.
IGYK	Government expenditure, all governments, investment, thousands of dollars.
JMETYK	Metals price index, gold-copper-silver-lead-zinc, 1971 = 1.000.
LCYK	Civilian labor force.
LGFBYK	Loans to business by federal government, thousands of dollars.
LGFPYK	Loans to persons by federal government, thousands of dollars.
LGFTYK	Loans to territorial government by federal government, thousands of dollars.
LGTLYK	Loans to municipalities and school districts by territorial government, thousands of dollars.
LGTPYK	Loans to persons by territorial government, thousands of dollars.
NYK	Population, total, other than active duty militar.
NBSVYK	Number of business establishments, service industries.
NBNSVYK	Number of business establishments, outside service industries.
NMIGYK	Net migration.
NSEYK	Number of self-employed (≡LCYK-UYK-ETOTYK)
QMICAYK	Quantity of ore milled, Cyprus Anvil Mine, thousands of tonnes.
QMIUKYK	Quantity of ore milled, United Keno Hill Mines, thousands of tonnes.

MNEMONIC	DESCRIPTION
RESCAYK	Quantity of reserves (end of year) Cyprus Anvil Mine, thousands of tonnes.
RESUKYK	Quantity of reserves (end of year), United Keno Hill Mines, thousands of tonnes.
RFPITYK	Personal income tax collections, federal government, thousands of dollars.
RGPYK	Royalties paid on placer gold, troy ounces.
RLINVYK	Local government revenue from investments, thousands of dollars.
RLITYK	Local government revenue, indirect taxes, thousands of dollars.
RLOCYK	Local government revenue, "other" current, thousands of dollars.
RLYK	Local government revenue, total, thousands of dollars.
RMICAYK	Revenue per tonne of ore milled, Cyprus Anvil Mine, 1980 dollars.
RMIUKYK	Revenue per tonne of ore milled, United Keno Hill Mines, 1980 dollars.
RTINVYK	Territorial government revenue from investments, thousands of dollars.
RTITYK	Territorial government revenue, indirect taxes, thousands of dollars.
RTLPLYK	Territorial government revenue, loan repayments from municipalities and school districts, thousands of dollars.
RTLPPYK	Territorial government revenue, loan repayments from persons, thousands of dollars.
RTOCYK	Territorial government revenue, "other" current, thousands of dollars.
RTYK	Territorial government revenue, total, thousands of dollars.
RUYK	Unemployment rate, (=100*UYK/LCYK).
TOURNYK	Number of visitors.

MNEMONIC	DESCRIPTION
TOURXYK	Estimated expenditure by visitors, thousands of dollars.
UYK	Number of unemployed.
VBPNRYK	Value of nonresidential building permits, thousands of dollars.
VBPYK	Transfer payments from corporations to persons and unincorporated business, thousands of dollars.
VGFBYK	Transfer payments from federal government to business, thousands of dollars.
VGFLYK	Transfer payments from federal government to local government, thousands of dollars.
VGFPYK	Transfer payments from federal government to persons, thousands of dollars.
VGFTYK	Transfer payments from federal government to territorial government, thousands of dollars.
VGLPYK	Transfer payments from local government to persons, thousands of dollars.
VGLTYK	Transfer payments from local government to territorial government, thousands of dollars.
VGTBYK	Transfer payments from territorial government to business, thousands of dollars.
VGTFYK	Transfer payments from territorial government to federal government, thousands of dollars.
VGTLYK	Transfer payments from territorial government to local governments, thousands of dollars.
VGTPYK	Transfer payments from territorial government to persons, thousands of dollars.
VPYK	Total transfer payments to persons, thousands of dollars.
VPRYK	Total value of residential building permits issued, thousands of dollars.

MNEMONIC	DESCRIPTION
VPTYK	Transfer payments from persons to territorial government, thousands of dollars.
WCYK	Payrolls, construction, thousands of dollars.
WGFEDYK	Civilian payrolls, federal government, thousands of dollars.
WGLYK	Payrolls, local government, thousands of dollars.
WGTYK	Payrolls, territorial government, thousands of dollars.
WMIYK	Payrolls, mining, thousands of dollars.
WSYK	Wage and salary payments, all industries, thousands of dollars.
WSVYK	Payrolls, service industries, thousands of dollars.
WTCUYK	Payrolls, transportation-communications-utilities, thousands of dollars.
YDYK	Disposable personal income, thousands of dollars.
YINVYK	Personal investment income, thousands of dollars.
YMILYK	Military pay, thousands of dollars.
YPYK	Total personal income, thousands of dollars.
YTRADYK	Inputed income, traditional activities, personal, thousands of dollars.
YUNYK	Income of unincorporated enterprises, thousands of dollars.

EXOGENOUS VARIABLES
(Economic Model)

MNEMONIC	DESCRIPTION
A	Projected real growth rate of total per capita federal spending in the Yukon, percent.
CPI	Canadian all items consumer price index, 1971 = 1.000.
EOYK	Employment other than mining, construction, government, transportation, service industries, communications and utilities, and forestry.
GTFLNYK	Territorial government spending, loan repayments to federal government, thousands of dollars.
IGFYK	Federal government spending in Yukon, investment, thousands of dollars.
IGLYK	Local government spending, investment, thousands of dollars.
IGTYK	Territorial government spending, investment, thousands of dollars.
JDIVT	Toronto stock dividend yield, percent.
JSTOCKT	Toronto stock index (close).
N	Population of Canada, thousands of persons.
NMILYK	Active duty military personnel in Yukon.
PCOPNY	Price of copper, U.S. dollars per metric tonne, New York market.
PGOLDNY	Price of gold, U.S. dollars per troy ounce, New York market.
PLEADNY	Price of lead, U.S. dollars per metric tonne, New York market.
PPHYK	Number of persons per occupied housing unit.

MNEMONIC	DESCRIPTION
PSILVNY	Price of silver, U.S. dollars per troy ounce, New York market.
PZINCNY	Price of zinc, U.S. dollars per metric tonne, New York market.
RGC510	Yield on 5-10 year Government of Canada bonds, percent.
RLDEFYK	Local government deficit, thousands of dollars.
RTBIL	Yield on 3 month Government of Canada Treasury bills, percent.
RTDEFYK	Territorial government deficit, thousands of dollars.
SF1,...,SF7	Federal government spending shares, defining items as a percent of GFCYK.
SL1,SL2,SL6	Local government spending shares, defining items as a percent of GLCYK-RTLPLYK.
ST1,...,ST7	Territorial government spending shares, defining items as a percent of GTCYK-GTFLNYK.
TIME	Time (= 1.0 in 1967).
TIMYK	Total forestry production, thousands of cubic meters.
VPLYK	Transfer payments from persons to local government, thousands of dollars.
XRTE	U.S.-Canada foreign exchange rate spot, (i.e. U.S. dollar price of one Canadian dollar).

DATA SOURCES
(ECONOMIC MODEL)

NOTES:
(1) DIAND - DEPARTMENT OF INDIAN AND NORTHERN AFFAIRS.
(2) MILLER REPORT - "IMPACT ON THE YUKON ECONOMY OF THE GOLD PLACER MINING INDUSTRY," 1979, and 1980 - PREPARED FOR THE KLONDIKE GOLD PLACER MINERS ASSOCIATION BY M.E. MILLER AND ASSOCIATES, LTD.
(3) CANSIM - DATABASE MAINTAINED BY STATISTICS CANADA.
(4) MNEMONICS ENDING IN "YK" DENOTE YUKON DATA.
(5) YUKON ECONOMIC ACCOUNTS PREPARED BY DIAND.
(6) YUKON ECONOMIC INDICATORS PREPARED BY YUKON DEPARTMENT OF ECONOMIC DEVELOPMENT AND INTERGOVERNMENTAL RELATIONS, PERIODIC.
(7) YUKON ECONOMIC REVIEW PREPARED BY YUKON DEPARTMENT OF ECONOMIC DEVELOPMENT AND INTERGOVERNMENTAL RELATIONS, QUARTERLY.

DATA SOURCES
(Economic Model)

MNEMONIC	SOURCE
A	Judgemental. Forecast period only.
AECYK	Ratio of WCYK to ECYK.
AEGFYK	Ratio of WGFEDYK to EGFEDYK.
AEGLYK	Ratio of WGLYK to EGLYK.
AEGTYK	Ratio of WGTYK to EGTYK.
AEMIYK	Ratio of WMIYK to EMIYK.
AESVYK	Ratio of WSVYK to ESVYK.
AETCUYK	Ratio of WTCUNYK to (ETYK + ECUYK).
BYK	Statistics Canada catalogue 84-204.
BDEPYK	Constructed. See text.
CYK	Constructed. See text.
CDYK	Constructed. See text.
CNDYK	Constructed. See text.
CPI	Cansim matrix 4995, Series D451000.
CPIYK	Whitehorse, Watson Lake, and Dawson City components from Yukon Economic Review, Population weights: Wh (.8647), WL (.0698), DC (.0654).
DYK	Statistics Canada catalogue 84-204.
ECYK	Yukon Economic Review, Yukon Economic Indicators, estimated 1972-1976. See text.
ECUYK	Same as ECYK
EGFEDYK	Yukon Economic Review, Yukon Economic Indicators.
EGLYK	Same as EGFEDYK.
EGTYK	Same as EGFEDYK.
ELUMYK	Same as EGFEDYK.
EMIYK	Yukon Economic Review, Yukon Economic Indicators, data prior to 1977 backcasted using percent changes estimated by authors of Yukon Economic Model Update 1981.

MNEMONIC	SOURCE
EMICAYK	Yukon Mines and Mineral Activities, various years, DIAND, adjusted for seasonality to year-round equivalent.
EMIPYK	Constructed from data in Miller Report, 1979 and 1980, and DIAND estimates of royalties paid on placer gold produced. See text.
EMIUKHYK	Same as EMICAYK.
EMIXYK	Total mining employment less (1) estimates of employment in producing mines taken from Yukon Mines and Mineral Activities and (2) estimated placer mining employment.
EOYK	Defined by identity. See definition.
ESVYK	Same as ECYK.
ETYK	Same as ECYK.
ETOTYK	Same as EMIYK.
GFYK	Yukon Economic Accounts. total outlays (Table 7) plus estimated share (57.4%) of total government gross fixed capital formation (Table 11).
GFCYK	Yukon Economic Accounts, Total outlays (Table 7).
GFOCYK	Yukon Economic Accounts, (Table 7).
GLYK	Yukon Economic Accounts, total outlays (Table 9) plus estimated share (5.4%) of total government gross fixed capital formation (Table 11).
GLCYK	Yukon Economic Accounts, total outlays, (Table 9).
GLOCYK	Yukon Economic Accounts, (Table 9).
GOLDPYK	DIAND. Converted to Troy ounces using 1 troy ounce = 31.103 grams.
GTYK	Yukon Economic Accounts, total outlays (Table 8) plus estimated share (37.2%) of total government gross fixed capital formation (Table 11).

MNEMONIC	SOURCE
GTCYK	Yukon Economic Accounts, (Table 8).
GTFLNYK	Yukon Economic Accounts, (Table 8).
GTOCYK	Yukon Economic Accounts, (Table 8).
HADYK	Census of Canada, 1981.
HHYK	Census of Canada, 1981.
HOYK	Census of Canada, 1981.
HSAYK	Census of Canada, 1981.
HSDYK	Census of Canada, 1981.
IGYK	Yukon Economic Accounts, gross fixed capital formation, (Table 11).
IGFYK	Estimated. Used over forecast period only to build estimates of IGYK.
IGLYK	Same as IGFYK.
IGTYK	Same as IGFYK.
JDIVT	Cansim matrix 2566, series B4237.
JMETYK	Constructed. See text.
JSTOCKT	Cansim matrix 2566, series B4245.
LCYK	Yukon Economic Review. Estimates prior to 1978. See text.
LGFBYK	Yukon Economic Accounts, (Table 7).
LGFPYK	Yukon Economic Accounts, (Table 7).
LGFTYK	Yukon Economic Accounts, (Table 7).
LGTLYK	Yukon Economic Accounts, (Table 8).
LGTPYK	Yukon Economic Accounts, (Table 8).
N	Cansim matrix 1, series D1.
NYK	Yukon Economic Review (1976-1982); Statistics Canada catalogue 91-518 occasional (1971-1975); Statistics Canada catalogue 91-512 occasional (1967-1970).
NBUSNSVYK	Yukon Economic Review, total less services.
NBUSSVYK	Yukon Economic Review.
NMIGYK	Defined by identity. See definitions.
NMILYK	Whitehorse detachment.
NSEYK	Defined by identity. See definitions.

MNEMONIC	SOURCE
PCOPNY	Commodity Trade and Price Trends, August 1982, a World Bank publication distributed by Johns Hopkins University Press, (Baltimore) current data available in Metals Week, a publication of McGraw-Hill.
PGOLDNY	Mineral Facts and Problems, 1980 edition, U.S. Bureau of Mines (U.S. Government Printing Office, Washington, D.C.), data since 1979 from Metals Week, a publication of McGraw-Hill.
PLEADNY	Same as PCOPNY.
PPHYK	Census of Canada, 1981.
PSILVNY	Same as PGOLDNY.
PZINCNY	Same as PCOPNY.
QMICAYK	Yukon Mines and Mineral Activities, DIAND.
	Yukon Mines and Mineral Activities, DIAND.
RESCAYK	Yukon Mines and Mineral Activities, DIAND.
RESUKHYK	Yukon Mines and Mineral Activities, DIAND.
RFPITYK	Yukon Economic Accounts, (Table 7).
RGOLDPYK	Miller Report, 1979 and 1980.
RLDEFYK	Judgemental. Forecast period only.
RLINVYK	Yukon Economic Accounts, (Table 9).
RLITYK	Yukon Economic Accounts, (Table 9).
RLOCYK	Yukon Economic Accounts, (Table 9).
RLYK	Yukon Economic Accounts, (Table 9), total income plus "other" current revenues.
RMICAYK	Estimated. See equation.
RMIUKHYK	Estimated. See equation.
RTDEFYK	Judgemental. Forecast period only.
RTINVYK	Yukon Economic Accounts, (Table 8).
RTITYK	Yukon Economic Accounts, (Table 8).
RTLPLYK	Yukon Economic Accounts, (Table 8).
RTOCYK	Yukon Economic Accounts, (Table 8).
RTYK	Yukon Economic Accounts, (Table 8), total income plus "other" current revenues.
RUYK	100 X UYK/LCYK.

MNEMONIC	SOURCE
TIMYK	Yukon Economic Review.
TOURNYK	Yukon Economic Review, Yukon Economic Indicators (1967-1976).
TOURXYK	Yukon Economic Indicators (1967-1977); Yukon Tourism Industry Highlights 1981, est. 1978-1980.
UYK	Yukon Economic Review, (1978-1981). Estimated 1967-1977. See text.
VBPNRYK	Statistics Canada, catalogue Sum of industrial, institutional, and commercial.
VBPYK	Yukon Economic Accounts, (Table 14).
VGFBYK	Yukon Economic Accounts, (Table 7).
VGFLYK	Yukon Economic Accounts, (Table 7).
VGFPYK	Yukon Economic Accounts, (Table 7).
VGFTYK	Yukon Economic Accounts, (Table 7).
VGLPYK	Yukon Economic Accounts, (Table 9).
VGLTYK	Yukon Economic Accounts, (Table 9).
VGTBYK	Yukon Economic Accounts, (Table 8).
VGTFYK	Yukon Economic Accounts, (Table 8).
VGTLYK	Yukon Economic Accounts, (Table 8).
VGTPYK	Yukon Economic Accounts, (Table 8).
VPYK	Defined by identity. See equation.
VPLYK	Yukon Economic Accounts, (Table 9).
VPRYK	Statistics Canada, catalogue
VPTYK	Yukon Economic Accounts, (Table 8).
WCYK	Yukon Economic Accounts, (Table 22).
WGFEDYK	Yukon Economic Review.
WGLYK	Yukon Economic Review.
WGTYK	Yukon Economic Review.
WMIYK	Yukon Economic Accounts, (Table 22).
WSYK	Yukon Economic Accounts, (Table 22).
WTCUYK	Yukon Economic Accounts, (Table 22).
XRTE	Cansim matrix 926, series B3400.

MNEMONIC	SOURCE
YDYK	Defined to equal YPYK less RFPITYK.
YINVYK	Yukon Economic Accounts, (Table 14).
YMILYK	Yukon Economic Accounts, (Table 5).
YPYK	Yukon Economic Accounts, (Table 5).
YTRADYK	Yukon Economic Accounts, (Table 5).
YUNYK	Yukon Economic Accounts, (Table 5).

APPENDIX C

HISTORICAL DATA

YEAR	FGTYK	EGLYK	WMIYK	WLUMYK	WCYK	USVYK
1967	0	0	6053	218	659	4216
1968	0	0	9228	196	1129	4896
1969	0	0	10877	237	1603	5959
1970	0	0	15293	132	1742	7011
1971	0	0	15439	111	1295	7705
1972	1209	123	15666	202	2859	9352
1973	1443	149	16926	565	1755	10210
1974	1657	149	19452	556	4695	11592
1975	1543	145	28473	939	12339	15175
1976	1550	152	21575	573	14250	17956
1977	1698	167	30532	1035	19670	17137
1978	1755	168	31931	1095	21590	23115
1979	1958	159	0	0	0	0
1980	2013	176	0	0	0	0
1981	2053	211	0	0	0	0

YEAR	WTOTYK	WTCUYK	WGFEDYK	WGTYK	WGLYK	WBUSYK
1967	23270	1879	0	0	0	0
1968	35316	2392	0	0	0	0
1969	41453	3322	0	0	0	0
1970	50282	4845	0	0	0	0
1971	53936	5919	0	0	0	0
1972	63159	7298	7552	12078	1097	0
1973	69890	9017	7592	14523	1429	0
1974	84726	9186	11225	16134	1520	0
1975	112850	17529	13931	16928	1925	0
1976	122181	18754	15926	19588	2037	0
1977	145493	21775	19454	23291	2865	909
1978	167097	12170	19791	26676	2673	1681
1979	0	0	21783	30331	2935	1638
1980	0	0	23271	33356	3300	1156
1981	0	0	27174	39309	4774	1327

NOTE: WWSVYK=WBUSYK-WWSVYK; WWSVYK=WWSSVYK

YEAR	WWSSVYK	WYK	LCYK	TOURNYK	TOURXYK	VAPYK
1967	0	762	7758	97200	7044	5
1968	0	552	7758	119142	7691	7
1969	0	761	8275	137262	9992	9
1970	0	751	9792	155416	10167	11
1971	0	1021	9516	173641	11939	25
1972	0	1193	10935	270397	21769	17
1973	0	1321	10502	311374	25021	22
1974	0	1723	11231	325310	25161	25
1975	0	2091	12099	318063	27339	32
1976	0	2316	12463	305792	23979	52
1977	546	1995	12501	306154	29079	97
1978	617	2215	12254	362965	19711	163
1979	626	1677	11463	352174	33495	0
1980	712	1523	11535	346495	32681	0
1981	772	1457	13222	335773	31066	0

NOTE: RGOLDYK=RGPYK

YEAR	VPYK	YDYK	CPIYK	CPI	PGOLDNY	RGOLDYK
1957	0	29969	.522	.8649	35	0
1958	0	35437	.549	.9002	39.26	0
1959	0	39933	.578	.9407	41.51	0
1970	0	44707	.602	.9728	35.41	0
1971	0	53602	.628	1	41.25	5893
1972	0	63041	.66	1.0977	58.6	5293
1973	0	72541	.72	1.127	97.91	9569
1974	0	89768	.72	1.125	159.74	12135
1975	0	117863	.917	1.3952	161.49	19379
1976	0	130348	1	1.4992	125.32	21312
1977	0	154269	1.095	1.6092	148.31	25592
1978	0	170793	1.213	1.7515	193.55	25738
1979	0	193265	1.386	1.9117	307.5	35075
1980	0	219873	1.57	2.1063	612.56	73026
1981	0	309453	1.923	2.3699	459.68	0

YEAR	EMIPYK	EMIXYK	PCOPNY	PLEADNY	PZINCNY	PSILVNY
1957	3	0	983	309	315	1.55
1958	0	0	923	291	309	2.14
1959	0	0	1093	329	333	1.79
1970	0	0	1272	348	349	1.77
1971	27	264	1138	304	356	1.56
1972	26	315	1115	331	391	1.69
1973	42	304	1293	359	455	2.55
1974	66	292	1695	497	793	4.71
1975	96	307	1801	475	959	4.42
1976	105	379	1517	509	923	4.35
1977	129	289	1451	577	758	4.62
1978	129	300	1888	792	593	5.8
1979	174	331	2034	1151	922	11.09
1980	463	342	2257	935	925	19
1981	0	834	1946	805	792	10

YEAR	YRT=	YD	RTRIL	RGCSIO	RDEP	CD
1967	.3258	83123	8.68	5.98	11659	5915
1968	.3321	86320	6.21	5.35	12807	6494
1969	.9321	90911	7.19	7.75	14990	5975
1970	.9999	98997	5.93	7.58	15993	6799
1971	.9978	99983	3.56	5.15	17893	7993
1972	1.0048	99169	3.56	5.78	19150	3990
1973	1.0532	99719	5.47	7.16	22031	11831
1974	1.0699	98585	7.32	8.27	23031	13139
1975	.9339	119995	7.19	7.15	32260	15320
1976	.3359	125519	8.37	8.72	37175	17021
1977	.9137	134698	7.21	8.13	43903	19315
1978	.3932	159975	8.63	9.69	53533	26555
1979	.3561	173816	11.69	10.16	57559	33678
1980	.3558	195332	12.79	12.29	70377	39194
1981	.3342	225013	11.72	10.99	82379	36567

YEAR	Y	C	JSTOCKT	JDIVT	RTLPLYR	RTLPPYR
1967	20364	39972	895	3.54	29	12
1968	20512	43709	931	3.45	31	15
1969	20994	47492	1037	3.18	32	43
1970	21239	50327	911	3.18	31	32
1971	21550	55516	967	3.32	39	120
1972	21793	62208	1139	2.77	45	33
1973	22040	71278	1217	2.79	84	218
1974	22357	83399	1017	4.25	97	234
1975	22533	96995	1009	4.75	205	16
1976	22901	110386	1035	4.49	269	29
1977	23276	122510	1010	4.32	335	358
1978	23523	135153	1159	4.5	300	0
1979	23761	150521	1577	4.15	0	0
1980	24045	169393	2126	3.77	0	0
1981	24331	191025	2159	4.05	0	0

YEAR	RSHRT	HSOMP	-------	-------	-------	-------
1967	8.07	149244				
1968	9.05	170992				
1969	7.94	195923				
1970	10.48	175823				
1971	9.43	201232				
1972	9.21	232229				
1973	9.59	246590				
1974	11.24	257248				
1975	11.43	216954				
1976	11.79	236249				
1977	10.36	251799				
1978	10.59	246532				
1979	11.97	226499				
1980	14.32	176163				
1981	19.15	133944				

YEAR	LGTLYK	LGTPYK	GTFLNYK	RLINYYK	RLITYK	RTOCYK
1957	0	360	464	7	578	983
1958	0	440	572	15	661	879
1959	150	328	756	32	750	1233
1970	546	424	993	20	935	1025
1971	339	347	1397	23	997	1171
1972	499	102	1479	30	1205	1972
1973	194	55	2104	39	1489	2650
1974	971	14	1893	40	1859	2851
1975	1516	6	1003	32	1515	1348
1976	2096	2	485	113	1940	2264
1977	5100	0	1017	114	2359	3801
1978	3001	0	3026	20	3088	1455
1979	0	0	0	0	0	0
1980	0	0	0	0	0	0
1981	0	0	0	0	0	0

YEAR	RLOCYK	RLOCYK	GFOCYK	DYK	RYK	NTK
1957	571	289	8045	73	385	15000
1958	753	299	8399	84	370	15000
1959	791	318	7196	95	462	16005
1970	954	165	6353	109	451	17000
1971	1191	515	5981	104	506	18900
1972	1451	552	8010	103	451	19500
1973	1741	843	8724	111	420	20500
1974	2099	565	14184	114	495	20500
1975	3464	1536	21546	112	403	21300
1976	4691	2204	23575	123	449	21836
1977	5482	2565	15046	105	428	23113
1978	7548	2835	15157	99	447	23305
1979	0	0	0	127	501	24007
1980	0	0	0	128	476	24137
1981	0	0	0	137	525	25121

NOTE: VPINDYK+VPINTYK+VPCOMYK=VRPYRYK

YEAR	STOTYK	VPRYK	VPINDYK	VPINTYK	VPCOMYK	EMIYK
1957	5833	0	0	0	0	1075
1958	5633	0	0	0	0	1126
1959	5996	0	0	0	0	1190
1970	6397	0	0	0	0	1236
1971	7336	0	0	0	0	1295
1972	7818	2307	0	0	429	1203
1973	7532	8000	12000	0	5000	1235
1974	7773	0	0	0	0	1234
1975	8103	0	0	0	0	1404
1976	8216	23	5	0	0	1293
1977	8523	5041	18	1351	1261	1427
1978	8561	13337	2256	4359	3618	1429
1979	9022	16333	2541	4262	3618	1154
1980	9132	16336	10336	4513	5073	1245
1981	10574	3104	9272	11275	7772	1542

YEAR	VGTPYK	VGTLYK	VGTDYK	VHLYK	VGLPYK	LGFTYK
1957	1321	333	2	0	5	1962
1958	1519	405	2	0	3	3533
1959	1500	376	2	34	4	6496
1960	2534	737	165	97	7	5892
1961	3117	372	119	427	0	4600
1962	3437	975	197	224	4	7905
1963	4452	948	291	131	1	5844
1964	4935	1221	576	100	1	15083
1965	3125	2015	3427	0	4	1910
1966	4363	3050	2490	5	3	3056
1967	4253	3152	2495	0	17	3537
1968	7365	3647	1925	0	71	5000
1969	0	0	0	0	0	0
1990	0	0	0	0	0	0
1991	0	0	0	0	0	0

YEAR	LGFBYK	LGFPYK	RFPITYK	RTINVYK	RTITYK	GTOCYK
1967	4244	0	5144	116	1324	2490
1968	5023	0	6743	182	2574	3669
1969	2242	0	8399	306	3114	4594
1970	3394	60	10225	304	3354	4803
1971	3405	40	10933	388	4951	6095
1972	5947	117	11744	523	4437	9428
1973	13540	294	14491	781	4542	12463
1974	27536	22	18727	993	6307	14623
1975	18,84	2534	22810	1592	8182	16013
1976	14892	2594	23050	2414	7640	20901
1977	3403	4022	28249	3676	7449	20784
1978	7500	2159	30720	2959	8958	26525
1979	0	0	38100	0	0	0
1980	0	0	45383	0	0	0
1981	0	0	57146	0	0	0

YEAR	ELHHYK	ECYK	ESVYK	STYK	SCUYK	SGFEDYK
1957	0	0	0	0	0	0
1958	0	0	0	0	0	0
1959	0	0	0	0	0	0
1960	0	0	0	0	0	0
1961	0	0	0	0	0	0
1962	0	502	1940	596	342	1028
1963	0	776	1730	619	295	927
1964	0	653	1548	642	25,	1237
1965	0	512	1710	566	292	1378
1966	0	534	1852	689	328	1441
1967	26	592	1895	712	332	1450
1968	23	801	2031	741	346	1373
1969	31	644	2273	677	468	1400
1990	52	510	2499	645	492	1315
1991	27	590	3190	798	497	1365

YEAR	[illegible]	[illegible]	[illegible]	[illegible]	VGFPYK	VGTPYK
1967	31750	93	3549	10975	1635	643
1968	34550	1950	4000	9334	1773	612
1969	35900	3145	7913	11319	2185	926
1970	22200	-1736	9610	13489	2578	1113
1971	27400	2182	4000	12811	4194	1496
1972	33100	1446	5520	23127	5362	1481
1973	47400	3690	5957	23555	5648	1747
1974	57950	957	5006	26171	9633	1897
1975	37900	-10522	10900	43004	9812	2335
1976	21500	4544	12500	30337	11410	2974
1977	30000	1319	11400	37674	11343	2995
1978	33900	17603	17040	58653	8112	3932
1979	0	0	0	0	0	0
1980	0	0	0	0	0	0
1981	0	0	0	0	0	0

YEAR	YTRADYK	YPYK	YSYK	YHILYK	YUHYK	YTHVYK
1967	513	34013	28205	32	1693	1279
1968	591	42235	35772	35	2073	1376
1969	636	43331	40824	47	1927	1856
1970	564	58932	49917	37	2605	1953
1971	537	54535	53352	40	2709	2127
1972	652	74735	62809	47	2595	1914
1973	1327	87032	71574	56	3292	2361
1974	1319	107495	87148	59	3733	3653
1975	1416	140673	113190	69	4370	4355
1976	1455	153998	127621	311	4597	5433
1977	1344	132517	155152	404	5002	6140
1978	3596	201513	171310	160	5442	3697
1979	4161	228553	185903	175	6354	27753
1980	4601	261504	212751	192	7365	36933
1981	5284	371180	305031	216	10187	51115

YEAR	VGFTYK	VGFLYK	VPTYK	VPLYK	VGLTYK	VGFDYK
1967	7224	103	842	0	75	490
1968	10353	104	1202	0	94	770
1969	13071	94	1234	0	131	663.
1970	12751	99	1510	0	179	176
1971	16564	71	1535	0	216	132
1972	26731	92	2753	0	236	103
1973	29559	251	3589	0	345	59
1974	42319	431	3991	0	320	397
1975	49341	709	4497	254	1500	612
1976	55193	772	4543	295	2072	442
1977	55246	1348	4731	146	2295	592
1978	70559	1247	5193	31	964	964
1979	0	0	0	0	0	0
1980	0	0	0	0	0	0
1981	0	0	0	0	0	0

APPENDIX D

NEWYEM SIMULATION PROGRAM

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FILE: YEMAST   DATA      A1  VM/SP CMS (PUT8108+) - 02/13/83

NAME GGRANT 'YUKON ECONOMIC MODEL'  ;
REPL ;
SMPL 4 5 ;   LOAD ;
SMPL 8 32 ;
?EXOGENOUS VARIABLES 1982-2006 ;
GENR A=0.02 ;?GROWTH RATE OF REAL PER CAPITA FEDERAL SPENDING;
FRML CPIQ CPI=1.05*CPI(-1) ;
FRML EOYKQ EOYK=1.01*EOYK(-1) ;
FRML GTFLNYKQ GTFLNYK=GTFLNYK(-1) ;
FRML IGFYKQ IGFYK=(0.02+CPI/CPI(-1))*IGFYK(-1) ;
FRML IGLYKQ IGLYK=(0.02+CPI/CPI(-1))*IGLYK(-1) ;
FRML IGTYKQ IGTYK=(0.02+CPI/CPI(-1))*IGTYK(-1) ;
FRML JDIVTQ JDIVT=JDIVT(-1) ;
FRML JSTOCKTQ JSTOCKT=JSTOCKT(-1)*CPI/CPI(-1) ;
FRML NQ N=1.02*N(-1) ;
FRML NMILYKQ NMILYK=NMILYK(-1) ;
FRML PCOPNYQ PCOPNY=(.02+CPI/CPI(-1))*PCOPNY(-1) ;
FRML PGOLDNYQ PGOLDNY=(.02+CPI/CPI(-1))*PGOLDNY(-1) ;
FRML PLEADNYQ PLEADNY=(.02+CPI/CPI(-1))*PLEADNY(-1) ;
FRML PPHYKQ PPHYK=PPHYK(-1) ;
FRML PSILVNYQ PSILVNY=(.02+CPI/CPI(-1))*PSILVNY(-1) ;
FRML PZINCNYQ PZINCNY=(.02+CPI/CPI(-1))*PZINCNY(-1) ;
FRML RGC510Q RGC510=RGC510(-1)+100*(CPI/CPI(-1)-CPI(-1)/CPI(-2)) ;
FRML RMORTQ RMORT=RMORT(-1)+100*(CPI/CPI(-1)-CPI(-1)/CPI(-2)) ;
FRML RLDEFYKQ RLDEFYK=0 ;
FRML RTBILQ RTBIL=RTBIL(-1)+100*(CPI/CPI(-1)-CPI(-1)/CPI(-2)) ;
FRML RTDEFYKQ RTDEFYK=0 ;
FRML SF1Q SF1=SF1(-1) ;
FRML SF2Q SF2=SF2(-1) ;
FRML SF3Q SF3=SF3(-1) ;
FRML SF4Q SF4=SF4(-1) ;
FRML SF5Q SF5=SF5(-1) ;
FRML SF6Q SF6=SF6(-1) ;
FRML SF7Q SF7=SF7(-1) ;
FRML SL1Q SL1=SL1(-1) ;
FRML SL2Q SL2=SL2(-1) ;
FRML SL6Q SL6=SL6(-1) ;
FRML ST1Q ST1=ST1(-1) ;
FRML ST2Q ST2=ST2(-1) ;
FRML ST3Q ST3=ST3(-1) ;
FRML ST4Q ST4=ST4(-1) ;
FRML ST5Q ST5=ST5(-1) ;
FRML ST6Q ST6=ST6(-1) ;
FRML ST7Q ST7=ST7(-1) ;
FRML TIMEQ TIME=1.0+TIME(-1) ;
FRML TIMYKQ TIMYK=110.9 ;
FRML VPLYKQ VPLYK=(CPI/CPI(-1))*VPLYK(-1) ;
FRML XRTEQ XRTE=XRTE(-1) ;
FRML YDQ YD=N*CPI*(YD(-1)/(N(-1)*CPI(-1)));
LIST X1,   CPIQ,EOYKQ,GTFLNYKQ,IGFYKQ,IGLYKQ,IGTYKQ,JDIVTQ,JSTOCKTQ,
NQ,NMILYKQ,PCOPNYQ,PGOLDNYQ,PLEADNYQ,PSILVNYQ,PPHYKQ,PZINCNYQ,
RGC510Q,RMORTQ,RLDEFYKQ,RTBILQ,RTDEFYKQ,SF1Q,SF2Q,SF3Q,SF4Q,SF5Q,SF6Q,
SF7Q,SL1Q,SL2Q,SL6Q,ST1Q,ST2Q,ST3Q,ST4Q,ST5Q,ST6Q,ST7Q,
TIMEQ,TIMYKQ,VPLYKQ,XRTEQ,YDQ ;
LIST X2,  CPI,EOYK,GTFLNYK,IGFYK,IGLYK,IGTYK,
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FILE: YEMAST    DATA      A1   VM/SP CMS (PUT8108+) - 02/13/83

JDIVT,JSTOCKT,N,NMILYK,PCOPNY,PGOLDNY,PLEADNY,PSILVNY,PPHYK,
PZINCNY,RGC510,RMORT ,RLDEFYK,RTBIL,RTDEFYK,SF1,SF2,
SF3,SF4,SF5,SF6,SF7,SL1,SL2,SL6,ST1,ST2,ST3,ST4,ST5,ST6,
ST7,TIME,TIMYK,VPLYK,XRTE,YD ;
COLECT X1,X2,XMCD ;
SOLVE(DYNAM,TAG=S)XMCD;
GENR CPI=CPIS;
GENR EQYK=EQYKS;
GENR GTFLNYK=GTFLNYKS;
GENR IGFYK=IGFYKS;
GENR IGLYK=IGLYKS;
GENR IGTYK=IGTYKS;
GENR JDIVT=JDIVTS;
GENR JSTOCKT=JSTOCKTS;
GENR N=NS;
GENR NMILYK=NMILYKS;
GENR PCOPNY=PCOPNYS;
GENR PGOLDNY=PGOLDNYS;
GENR PLEADNY=PLEADNYS;
GENR PSILVNY=PSILVNYS;
GENR PPHYK=PPHYKS;
GENR PZINCNY=PZINCNYS;
GENR RGC510=RGC510S;
GENR RMORT=RMORTS;
GENR RLDEFYK=RLDEFYKS;
GENR RTBIL=RTBILS;
GENR RTDEFYK=RTDEFYKS;
GENR SF1=SF1S;
GENR SF2=SF2S;
GENR SF3=SF3S;
GENR SF4=SF4S;
GENR SF5=SF5S;
GENR SF6=SF6S;
GENR SF7=SF7S;
GENR SL1=SL1S;
GENR SL2=SL2S;
GENR SL6=SL6S;
GENR ST1=ST1S;
GENR ST2=ST2S;
GENR ST3=ST3S;
GENR ST4=ST4S;
GENR ST5=ST5S;
GENR ST6=ST6S;
GENR ST7=ST7S;
GENR TIME=TIMES;
GENR TIMYK=TIMYKS;
GENR VPLYK=VPLYKS;
GENR XRTE=XRTES;
GENR YD=YDS;
SMPL 5 32 ;
REPL ;
? NINE OUTPUT 1979-2006 FOR CA AND UKH ;
FRML CPIYKQ CPIYK=(1.0022+1.174*(CPI-CPI(-1))/CPI(-1))*CPIYK(-1) ;
FRML RMICAYKQ RMICAYK=(.024*PLEADNY+.0345*PZINCNY+.03216*25.177*PSILVNY+
.03216*.078*PGOLDNY)/(XRTE*CPI/2.106) ;
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FILE: YEMAST   DATA      A1  VM/SP CMS (PUT81CE+) - 02/13/83

FRML RMIUKYKQ  RMIUKYK=(.0278*PLEADNY+.0052*PZINCNY+.C3216*740*FSILVNY)
/(XRTE*CPI/2.106);
LIST X3,CPIYKQ,RMICAYKQ,RMIUKYKQ  ;
LIST X4,CPIYK,RMICAYK,RMIUKYK ;
COLECT X3,X4,XMOD1 ;
SOLVE(DYNAM,TAG=S)XMOD1;
GENR CPIYK=CPIYKS;
GENR RMICAYK=RMICAYKS;
GENR RMIUKYK=RMIUKYKS;
GENR QMICAYK=2923;
GENR QMIUKYK=84.56;
SMPL 5 5;
PROC,MINOUT;
REPL;
SET L1=RMICAYK;
SET L2=RMIUKYK;
IF L1<=57;THEN;GENR QMICAYK=0;
IF L2<=241;THEN;GENR QMIUKYK=0;
FRML RESCAYKQ RESCAYK=RESCAYK(-1)-QMICAYK ;
FRML RESUKYKQ RESUKYK=RESUKYK(-1)-QMIUKYK ;
LIST X5,RESCAYKQ,RESUKYKQ  ;
LIST X6,RESCAYK,RESUKYK ;
COLECT X5,X6,XMOD2 ;
SOLVE(DYNAM,TAG=S)XMOD2;
GENR RESCAYK=RESCAYKS;
GENR RESUKYK=RESUKYKS;
SET L3=RESCAYK(-1);
SET L4=RESUKYK(-1);
IF L3<=0;THEN;GENR QMICAYK=0;
IF L4<=0;THEN;GENR QMIUKYK=0;
GENR RGPYK1=-3000+122.5*PGOLDNY/(XRTE*CPI) ;
SET L5=RGPYK1;
GENR RGPYK=RGPYK1;
IF L5<=0;THEN;GENR RGPYK=0;
GENR GOLDPYK=1.125*RGPYK ;
ENDP,MINOUT;
SMPL 5 5;
MINOUT;
SMPL 6 6;
MINOUT;
SMPL 7 7;
MINOUT;
SMPL 8 8;
MINOUT;
SMPL 9 9;
MINOUT;
SMPL 10 10;
MINOUT;
SMPL 11 11;
MINOUT;
SMPL 12 12;
MINOUT;
SMPL 13 13;
MINOUT;
SMPL 14 14;
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FILE: YEMAST    DATA      A1   VM/SP CMS (FUT8108+) - 02/13/83

MINOUT;
SMPL 15 15;
MINOUT;
SMPL 16 16;
MINOUT;
SMPL 17 17;
MINOUT;
SMPL 18 18;
MINOUT;
SMPL 19 19;
MINOUT;
SMPL 20 20;
MINOUT;
SMPL 21 21;
MINOUT;
SMPL 22 22;
MINOUT;
SMPL 23 23;
MINOUT;
SMPL 24 24;
MINOUT;
SMPL 25 25;
MINOUT;
SMPL 26 26;
MINOUT;
SMPL 27 27;
MINOUT;
SMPL 28 28;
MINOUT;
SMPL 29 29;
MINOUT;
SMPL 30 30;
MINOUT;
SMPL 31 31;
MINOUT;
SMPL 32 32;
MINOUT;
SMPL 5 32;
PRINT GOLDPYK,RGPYK,AGPYK1,GMICAYK,GMIUKYK;
PRINT RESCAYK,RESUKYK,RMICAYK,RMIUKYK;
? NEWYEM SOLVED 1979-2006 ;
FRML AECYKQ AECYK=-50.28+77.9*CPIYK ;
FRML AEGFYKQ AEGFYK=-2.3022+9.4293*CPI ;
FRML AEGLYKQ AEGLYK=1.1014+12.4229*CPIYK ;
FRML AEGIYKQ AEGIYK=3.822+8.7716*CPIYK ;
FRML AEMIYKQ AEMIYK=.4544+18.1528*CPIYK ;
FRML AESVYKQ AESVYK=-.6105+9.69*CPIYK ;
FRML AETCUYKQ AETCUYK=-.136+15.268*CPIYK ;
FRML BYKQ BYK=.0192*NYK ;
FRML BDEPYKQ BDEPYK=(NYK*CPI/1000)*EXP(-1.646+1.38*LOG(YDYK/
(NYK*CPI))+.523*(RTEIL/100-CPI/CPI(-1)+1)) ;
FRML CDYKQ CDYK=YDYK*EXP(-1.4786+.25*LOG(BDEPYK*100/(NYK*
CPI))-.45*LOG(YDYK/(CPI*NYK))-.0047*(RTEIL+100-100*CPIYK/
CPIYK(-1))) ;
FRML CNDYKQ CNDYK=YDYK*(.8047-.0037*RTEIL-.19*CPIYK/CPIYK(-1)) ;
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FILE: YEMAST    DATA      A1   VM/SP CMS (PUT81CE+) - 02/13/83

FRML CYKQ CYK=CDYK+CNDYK ;
FRML DYKQ DYK=.0038*NYK ;
FRML ECYKQ ECYK=321+.0068*(IGYK+VPRYK+VEFRRYK)/CPIYK ;
FRML ECUYKQ ECUYK=-590.6+.0357*NYK+.4228*ECUYK(-1) ;
FRML EGFEDYKQ EGFEDYK=WGFEDYK/AEGFYK ;
FRML EGLYKQ EGLYK=WGLYK/AEGLYK ;
FRML EGTYKQ EGTYK=WGTYK/AEGTYK ;
FRML ELUMYKQ ELUMYK=.316*TIMYK ;
FRML EMIYKQ EMIYK=EMIPYK+EMICAYK+EMIUKYK+EMIXYK ;
FRML EMICAYKQ EMICAYK=.1434*QMICAYK ;
FRML EMIPYKQ EMIPYK=.00849*GOLDPYK ;
FRML EMIUKYKQ EMIUKYK=3.286*QMIUKYK ;
FRML EMIXYKQ EMIXYK=236.3+48.9*JMETYK(-1) ;
FRML ESVYKQ ESVYK=-657.8+.0116*((YDCYK+GFDCYK+GLDCYK+GTDCYK+
LGFPYK+LGFBYK+LGTPYK)/CPIYK+.0151*TCURXYK/CPIYK) ;
FRML ETYKQ ETYK=174.0+.0016*YDYK/CPIYK+.2133*EMIYK+
.007*ABS(NMIGYK) ;
FRML ETOTYKQ ETOTYK=EMIYK+ECYK+EGFECYK+EGTYK+EGLYK+ESVYK+
ETYK+ECUYK+ELUMYK+EGYK ;
FRML GFYKQ GFYK=CPIYK*NYK*(GFYK(-1)/(CPIYK(-1)*NYK(-1)))*(1+A) ;
FRML GFCYKQ GFCYK=GFYK-IGFYK ;
FRML GFDCYKQ GFDCYK=GFCYK-VGFTYK-VGFLYK-LGFTYK-VGFBYK-VGFFYK-
LGFBYK-LGFPYK-WGFEDYK ;
FRML GLYKQ GLYK=RLYK+RLDEFYK ;
FRML GLCYKQ GLCYK=GLYK-IGLYK ;
FRML GLDCYKQ GLDCYK=GLCYK-WGLYK-VGLTYK-VGLPYK-RTLPLYK ;
FRML GTYKQ GTYK=RTYK+RTDEFYK ;
FRML GTCYKQ GTCYK=GTYK-IGTYK ;
FRML GTDCYKQ GTDCYK=GTCYK-VGTFYK-VGTLYK-VGTEYK-VGTPYK-GTFLNYK-
LGTLYK-WGTYK-LGTPYK ;
FRML HADYKQ HADYK=.1572*HHYK ;
FRML HCOMPYKQ HCOMPYK=ABS(NYK-NYK(-1))*(3.171+.5342*(1000*BDEPYK/
(CPI*NYK))-1.38*LOG(RMORT)) ;
FRML HHYKQ HHYK=.94*HHYK(-1)+HCOMPYK ;
FRML HOYKQ HOYK=HHYK-HSDYK-HADYK-HSAYK ;
FRML HSAYKQ HSAYK=HHYK*(.1263+.0024*(TIME-15)) ;
FRML HSDYKQ HSDYK=HHYK*(.5842-.0081*(TIME-15)) ;
FRML IGYKQ IGYK=IGFYK+IGTYK+IGLYK ;
FRML JMETYKQ JMETYK=(PGOLDNY/41.25+PCOPNY/1134+PLEADNY/304+
PZINCNY/356+PSILVNY/1.55)/(XRTE*CPI*5) ;
FRML LCYKQ LCYK=NYK*(LCYK(-1)/NYK(-1)-.3876+
.3876*ETOTYK/ETOTYK(-1)) ;
FRML LGFBYKQ LGFBYK=SF7*GFCYK ;
FRML LGFPYKQ LGFPYK=SF5*GFCYK ;
FRML LGFTYKQ LGFTYK=SF3*GFCYK ;
FRML LGTLYKQ LGTLYK=ST5*(GTCYK-GTFLNYK) ;
FRML LGTPYKQ LGTPYK=ST7*(GTCYK-GTFLNYK) ;
FRML NBSVYKQ NBSVYK=168.2+.2076*ESVYK ;
FRML NBNSVYKQ NBNSVYK=-1029.5+.061*NYK ;
FRML NYKQ NYK=NYK(-1)+BYK-DYK+NMIGYK ;
FRML NMIGYKQ NMIGYK=-500+.535*(ETOTYK-ETOTYK(-1))+536.45*
ETOTYK(-1)/NYK(-1)+.00002*((ETOTYK-ETOTYK(-1))**2)+.0022*
ETOTYK(-1) ;
FRML NSEYKQ NSEYK=LCYK-UYK-ETOTYK ;
FRML RFPITYKQ RFPITYK=.1605*YPYK ;

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FILE: YEMAST   DATA      A1   VM/SP CMS (PUT8108+) - 02/13/83

FRML RLINVYKQ RLINVYK=EXP(1.7953+.546*LOG((RTEIL/100)*
ABS(RLUCYK+RLITYK+VGFLYK+VGTLYK-WGLYK-GLCCYK)));
FRML RLITYKQ RLITYK=81.5536+.0107*YDYK+.0242*TOURXYK ;
FRML RLCCYKQ RLCCYK=-554.806+.0193*YDYK ;
FRML RLYKQ RLYK=VPLYK+RLINVYK+RLITYK+RLCCYK+VGFLYK+VGTLYK+LGTLYK ;
FRML RTINVYKQ RTINVYK=-674.7+.614*RTINVYK(-1)+202.1*(RTEIL-RTEIL(-1))/2+
(LGTLYK+LGTPYK)*RGC510/100-(RTLPLYK(-1)+RTLPPYK(-1))*(RGC510(-1)+
RGC510(-2)+RGC510(-3))/300 ;
FRML RTITYKQ RTITYK=1299.46+.03734*YDYK+.04636*TOURXYK ;
FRML RTLPLYKQ RTLPLYK=-120.8+.0285*(LGTLYK(-1)+LGTLYK(-2)+LGTLYK(-3)+
LGTLYK(-4)+LGTLYK(-5))+5008.4*RTLPLYK(-1)/(LGTLYK(-1)+LGTLYK(-2)+
LGTLYK(-3)+LGTLYK(-4)+LGTLYK(-5));
FRML RTLPPYKQ RTLPPYK=.2*(LGTPYK(-1)+LGTPYK(-2)+LGTPYK(-3)+LGTPYK(-4)+
LGTPYK(-5)) ;
FRML RTCCYKQ RTCCYK=CPIYK*EXP(-.725+.4905*LOG(WSYK/CPIYK)+.2839*
LOG(TOURXYK/CPIYK));
FRML RTYKQ RTYK=VPTYK+RTINVYK+RTITYK+RTCCYK+RTLPLYK+RTLPPYK+VGFTYK+
LGFTYK+VGLTYK ;
FRML RUYKQ RUYK=RUYK(-1)*(1+LCYK/LCYK(-1)-ETOTYK/ETOTYK(-1)) ;
FRML TOURNYKQ TOURNYK=-241358.5+110085.5*(YC/(CPI*N))+47260.2*
LOG(TIME)+61988.6*XRTE ;
FRML TOURXYKQ TOURXYK=.0808*TOURNYK*CPIYK ;
FRML UYKQ UYK=(RUYK/100)*LCYK ;
FRML VBPNRYKQ VBPNRYK=CPIYK*(-24666.3+3.92*(ETOTYK(-1)+
ETOTYK)/2) ;
FRML VBPYKQ VBPYK=-56.7+.00196*(WSYK-WGFEDYK-WGTYK-WGLYK)-.068*RTBIL*
VBPYK(-1) ;
FRML VGFBYKQ VGFBYK=SF4*GFCYK ;
FRML VGFLYKQ VGFLYK=SF2*GFCYK ;
FRML VGFPYKQ VGFPYK=CPIYK*NYK*(-.1512+.065*(WSYK/(CPIYK*NYK))+
2.02*UYK/LCYK) ;
FRML VGFTYKQ VGFTYK=SF1*GFCYK ;
FRML VGLPYKQ VGLPYK=SL2*(GLCYK-RTLPLYK) ;
FRML VGLTYKQ VGLTYK=SL1*(GLCYK-RTLPLYK) ;
FRML VGTBYKQ VGTBYK=ST3*(GTCYK-GTFLNYK) ;
FRML VGTFYKQ VGTFYK=ST1*(GTCYK-GTFLNYK) ;
FRML VGTLYKQ VGTLYK=ST2*(GTCYK-GTFLNYK) ;
FRML VGTPYKQ VGTPYK=ST4*(GTCYK-GTFLNYK) ;
FRML VPYKQ VPYK=VGFPYK+VGTPYK+VGLPYK+VBPYK ;
FRML VPRYKQ VPRYK=(CPIYK/1.570)*(HADYK-HADYK(-1)+HSAYK-HSAYK(-1)+
HOYK-HOYK(-1))*15.724+(HSDYK-HSDYK(-1))*70.5 ;
FRML VPTYKQ VPTYK=3135.5*CPIYK+.06285*NYK ;
FRML WCYKQ WCYK=AECYK*ECYK ;
FRML WGFEDYKQ WGFEDYK=SF6*GFCYK ;
FRML WGLYKQ WGLYK=SL6*(GLCYK-RTLPLYK) ;
FRML WGTYKQ WGTYK=ST6*(GTCYK-GTFLNYK) ;
FRML WMIYKQ WMIYK=AEMIYK*EMIYK ;
FRML WSVYKQ WSVYK=AESVYK*ESVYK ;
FRML WSYKQ WSYK=EXP(.0327*LOG((EGYK+ELUMYK)*CPIYK)+.5472+
.9482*LOG(WMIYK+WCYK+WTCUYK+WSVYK+WGFEDYK+WGTYK+WGLYK));
FRML WTCUYKQ WTCUYK=AETCUYK*(ETYK+ECUYK) ;
FRML YDYKQ YDYK=YPYK-RFPITYK-VPTYK ;
FRML YINVYKQ YINVYK=NYK*EXP(.8301*LOG(JSTCCKT*JCIVT)-10.4072+
.368*LOG(RTBIL*BDEPYK));
FRML YMILYKQ YMILYK=(NMILYK/NMILYK(-1))*YMILYK(-1)*CPIYK/CPIYK(-1) ;

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FILE: YEMAST    DATA      A1  VM/SP CMS (PUT810E+) - 02/13/83

FRML YPYKQ YPYK=WSYK+YUNYK+YINVYK+YTRADYK+YMILYK+VPYK;
FRML YTRADYKQ YTRADYK=(CPIYK/CPIYK(-1))*YTRADYK(-1) ;
FRML YUNYKQ YUNYK=973.88+4.5283*NSEYK*CPIYK ;
LIST NEWYEM AECYKQ AEGFYKQ AEGLYKQ AEGTYKQ AEMIYKQ AESVYKQ AETCUYKQ
BYKQ BDEPYKQ CDYKQ CNDYKQ CYKQ DYKQ ECYKQ ECUYKQ EGFEDYKQ EGLYKQ
EGTYKQ ELUMYKQ EMIYKQ EMICAYKQ
EMIPYKQ EMIUKYKQ EMIXYKQ ESVYKQ ETYKQ ETOTYKQ GFYKQ GFCYKQ GFOCYKQ
GLYKQ GLCYKQ GLOCYKQ GTYKQ GTCYKQ GTOCYKQ HADYKQ HCOMPYKQ HHYKQ
HOYKQ HSAYKQ HSDYKQ IGYKQ JMETYKQ LCYKQ LGFBYKQ
LGFPYKQ LGFTYKQ LGTLYKQ LGTPYKQ NBSVYKQ NBNSVYKQ NYKQ NMIGYKQ
NSEYKQ RFPITYKQ RLINVYKQ RLITYKQ RLOCYKQ RLYKQ RTINVYKQ RTITYKQ
RTLPLYKQ RTLPPYKQ RTOCYKQ RTYKQ RUYKQ TCURNYKQ TOURXYKQ UYKQ VBPNRYKQ
VBPYKQ VGFBYKQ VGFLYKQ VGFPYKQ VGFTYKQ VGLPYKQ VGLTYKQ VGTBYKQ
VGTFYKQ VGTLYKQ VGTPYKQ VPYKQ VPRYKQ VPTYKQ WCYKQ WGFEDYKQ WGLYKQ
WGTYKQ WMIYKQ WSVYKQ WSYKQ WTCUYKQ YDYKQ YINVYKQ YMILYKQ YPYKQ
YTRADYKQ YUNYKQ ;
LIST NYENDOG AECYK AEGFYK AEGLYK AEGTYK AEMIYK AESVYK AETCUYK BYK
BDEPYK CDYK CNDYK CYK DYK ECYK ECUYK EGFEDYK EGLYK EGTYK ELUMYK
EMIYK EMICAYK EMIPYK EMIUKYK EMIXYK ESVYK ETYK ETOTYK GFYK GFCYK GFOCYK
GLYK GLCYK GLOCYK GTYK GTCYK GTOCYK HADYK HCOMPYK HHYK HOYK HSAYK
HSDYK IGYK JMETYK LCYK LGFBYK LGFPYK LGFTYK LGTLYK LGTPYK NBSVYK
NBNSVYK NYK NMIGYK NSEYK RFPITYK RLINVYK RLITYK RLOCYK RLYK RTINVYK
RTITYK RTLPLYK RTLPPYK RTOCYK RTYK RUYK TCURNYK TOURXYK UYK VBPNRYK
VBPYK VGFBYK VGFLYK VGFPYK VGFTYK VGLPYK VGLTYK VGTBYK VGTFYK VGTLYK
VGTPYK VPYK VPRYK VPTYK WCYK WGFEDYK WGLYK WGTYK WMIYK WSVYK WSYK
WTCUYK YDYK YINVYK YMILYK YPYK YTRADYK YUNYK ;
COLECT NEWYEM,NYENDOG,NEWYEMC ;
SMPL 5 22;
SOLVE(DYNAM,TAG=S,PRNSIM=OFF)NEWYEMC;
GENR NMIGYK=NMIGYKS;
IF NYK-NYK(-1)<0;THEN;TITLE '****WARNING  NEG PCP CHANGE,FIX
HCOMPYK****';ELSE;TITLE 'YUKON ECONOMIC MODEL';
PRINT AECYKS,AEGFYKS,AEGLYKS,AEGTYKS,AEMIYKS,AESVYKS;
PRINT AETCUYKS,BYKS,BDEPYKS,CDYKS,CNDYKS,CYKS;
PRINT DYKS,ECYKS,ECUYKS,EGFEDYKS,EGLYKS,EGTYKS;
PRINT ELUMYKS,EMIYKS,EMICAYKS,EMIPYKS,EMIUKYKS,EMIXYKS;
PRINT ESVYKS,ETYKS,ETOTYKS,GFYKS,GFCYKS,GFOCYKS;
PRINT GLYKS,GLCYKS,GLOCYKS,GTYKS,GTCYKS,GTOCYKS;
PRINT HADYKS,HCOMPYKS,HHYKS,HOYKS ,HSAYKS,HSDYKS;;
PRINT IGYKS,JMETYKS,LCYKS,LGFBYKS,LGFPYKS,LGFTYKS;
PRINT LGTLYKS,LGTPYKS,NBSVYKS,NBNSVYKS,NYKS,NMIGYKS;
PRINT NSEYKS,RFPITYKS,RLINVYKS,RLITYKS,RLOCYKS,RLYKS;
PRINT RTINVYKS,RTLPLYKS,RTLPPYKS,RTOCYKS,RTYKS;
PRINT RUYKS,TOURNYKS,TOURXYKS,UYKS,VBPNRYKS,VBPYKS;
PRINT VGFBYKS,VGFLYKS,VGFPYKS,VGFTYKS,VGLPYKS,VGLTYKS;
PRINT VGTBYKS,VGTFYKS,VGTLYKS,VGTPYKS,VPYKS,VPRYKS;
PRINT VPTYKS,WCYKS,WGFEDYKS,WGLYKS,WGTYKS,WMIYKS;
PRINT WSVYKS,WSYKS,WTCUYKS,YDYKS,YINVYKS,YMILYKS;
PRINT YPYKS,YTRADYKS,YUNYKS;
STOP ; END;
SMPL 4 5 ;
LOAD AECYK ;
51.923 51.923 ;
LOAD AEGFYK ;
14.414 14.414 ;
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FILE: YEMAST   DATA      A1  VM/SP CMS (PLT810E+) - 02/13/83

LOAD AEGLYK ;
16.299 16.299 ;
LOAD AEGIYK ;
15.200 15.200 ;
LOAD AEMIYK ;
22.345 22.345 ;
LOAD AESVYK ;
11.108 11.108 ;
LOAD AETCUYK ;
23.084 23.084; ? CONSTRUCTED. APPARENT BAD OBSERVATIONS ;
LOAD BYK ;
447 501;;
LOAD BDEPYK ; ?CONSTRUCTED ;
56.7 56.7;
LOAD CYK ; ? CONSTRUCTED ;
118254 118254 ;
LOAD CDYK ; ?CONSTRUCTED ;
22217 22217;
LOAD CNDYK ;? CONSTRUCTED ;
96037 96037;
LOAD CPIYK ;
1.213 1.346;
LOAD DYK ;
89 127;
LOAD ECYK ;
801 644;
LOAD ECUYK ;
346 468;
LOAD EGFEDYK ;
1373 1400;
LOAD EGLYK ;
164 159;
LOAD EGIYK ;
1755 1854;
LOAD ELUMYK ;
28 31;
LOAD EMIYK ;
1429 1154;
LOAD EMICAYK ;
459 459;
LOAD EMIPYK ;
128 128;
LOAD EMIUKYK ;
234 234;
LOAD EMIXYK ;
300 300;
LOAD ESVYK ;
2081 2273;
LOAD ETYK ;
741 677;
LOAD ETCIYK ;
9061 8922;
LOAD GFYK ;
155077 155077;
LOAD GFCYK ;
```

```
130480 130480;
LOAD GFCCYK ;
15157 15157;
LOAD GLYK ;
14724 14724;
LOAD GLCYK ;
11556 11556;
LOAD GLOCYK ;
7544 7544;
LOAD GGLDFYK ;
18691 18691;
LOAD GTYK ;
100522 100522;
LOAD GTCYK ;
78699 78699;
LOAD GTOCYK ;
26626 26626;
LOAD HADYK ;
1097 1097;
LOAD HCOMPYK ;
215 656;
LOAD HHYK ;
6937 6937;
LOAD HCYK ;
801 801;
LOAD HSAYK ;
829 829;
LOAD HSDYK ;
4210 4210;
LOAD IGYK ;
58664 58664;
LOAD JMETYK ; ? CONSTRUCTED ;
1.662 1.662;
LOAD LCYK ;
12264 11463;
LOAD LGFBYK ;
7500 7500;
LOAD LGFPYK ;
2159 2159;
LOAD LGFTYK ;
5000 5000;
SMPL 1 5 ;
LOAD LGTLYK ;
1516 2086 5100 5001 5001;
LOAD LGTPYK ;
6 2 0 0 0;
SMPL 4 5 ;
LOAD NBSVYK ;
617 620;
LOAD NBNSVYK ;
424 418;
LOAD NYK ;
23306 24007;
LOAD NMIGYK ;
-171 327;
```

```
FILE: YEMAST   DATA      A1  VM/SP CMS (PUT8108+) - 02/13/83

LOAD NSEYK ;
888 888;
LOAD OMICAYK ;
3280 3280;
LOAD OMIUKYK ;
81.7 81.7;
LOAD RESCAYK ;
34200 34200;
LOAD RESUKYK ;
708.9 708.9;
LOAD RFPITYK ;
30720 30720;
LOAD RGPYK1;
25780 25780;
LOAD RGPYK ;
25780 25780;
LOAD RLINVYK ;
20 20;
LOAD RLITYK ;
3088 3088;
LOAD RLOCYK ;
2836 2836;
LOAD RLYK ;
15870 15870;
LOAD RMICAYK ;
70.96 70.96;
LOAD RMIUKYK ;
234.38 234.38;
LOAD RTINVYK ;
2959 2959;
LOAD RTITYK ;
8868 8868;
LOAD RTLPLYK ;
300 300;
LOAD RTLPPYK ;
0 0;
LOAD RTOCYK ;
3455 3455;
LOAD RTYK ;
97298 97298;
LOAD RUYK ;
18.9 14.6;
LOAD TOURNYK ;
362905 362174;
LOAD TOURXYK ;
34711 38485;
LOAD UYK ;
2315 1677;
LOAD VBPNRYK ;
15180 14417;
LOAD VBPYK ;
103 103;
LOAD VGFBYK ;
964 964;
LOAD VGFLYK ;
```

```
1247 1247;
LOAD VGFPYK ;
8112 8112;
LOAD VGFTYK ;
70550 70550;
LOAD VGLPYK ;
71 71;
LOAD VGLTYK ;
968 968;
LOAD VGTBYK ;
1925 1925;
LOAD VGTFYK ;
7866 7866;
LOAD VGTLYK ;
3647 3647;
LOAD VGTPYK ;
3932 3932;
LOAD VPYK ;
12218 12218;
LOAD VPRYK ;
13387 13387;
LOAD VPTYK ;
5198 5198;
LOAD WCYK ;
41590 41590;
LOAD WGFEDYK ;
19791 21783;
LOAD WGLYK ;
2673 2935;
LOAD WGTYK ;
26676 30331;
LOAD WMIYK ;
31931 31931;
LOAD WSVYK ;
23115 23115;
LOAD WSYK ;
171310 171310;
LOAD WTCUYK ; ? CONSTRUCTED 1978 CBSERVATION ;
25092 25092;
LOAD YDYK ;
170793 170793;
LOAD YINVYK ;
8687 8687;
LOAD YMILYK ;
160 160;
LOAD YPYK ;
201513 201513;
LOAD YTRADYK ;
3696 3696;
LOAD YUNYK ;
5442 5442;
SMPL 4 7 ; ?EXOGENOUS VARIABLE 1978 TO 1981 ;
LOAD A ;
0 -.0391 -.089 -.0338 ;
SMPL 2 7 ;
```

```
FILE: YEMAST    DATA      A1  VM/SP CMS (PUT8108+) - 02/13/83

LOAD CPI ;
1.489 1.608 1.752 1.912 2.106 2.369 ;
SMPL 4 7 ;
LOAD EOYK ;
689 730 658 816 ;
LOAD GTFLNYK ;? ESTIMATED 1979 TO 1981 ;
3026 3480 4002 4602 ;
LOAD IGFYK ; ? CONSTRUCTED ;
33673 30041 27750 36644 ;
LOAD IGLYK ;? ESTIMATED ;
3168 2826 2611 3448 ;
LOAD IGTYK ; ? ESTIMATED ;
21823 19467 17986 23752 ;
LOAD JDIVT ;
4.50 4.15 3.77 4.06 ;
LOAD JSTOCKT ;
1159 1577 2126 2158 ;
LOAD K ;
23523 23761 24046 24331 ;
LOAD NMILYK ;
6 6 6 6 ;
LOAD PCOPNY ;
1444 2034 2257 1846 ;
LOAD PGOLDNY ;
193.55 307.50 612.56 459.64 ;
LOAD PLEADNY ;
742 1161 935 806 ;
LOAD PPHYK ;
3.34 3.33 3.32 3.31 ;
LOAD PSILVNY ; ? 1980,1981 OBSERVATIONS ARE APPROXIMATE. UPDATE  ;
5.40 11.09 18.00 10.00 ;
LOAD PZINCNY ;
683 822 825 982 ;
SMPL 2 7 ;
LOAD RGC510 ;
8.72 8.13 9.08 10.16 12.29 15.29 ;
SMPL 4 7 ;
LOAD RMORT ;
10.59 11.97 14.32 18.15 ;
LOAD RLDEFYK ;
0 0 0 0 ;
LOAD RTBIL ;
8.68 11.69 12.79 17.72 ;
LOAD RTDEFYK ;
0 0 0 0 ;
LOAD SF1; ?ESTIMATED 1979 TO 1981 ;
.541 .541 .541 .541 ;
? ALL SHARE VARIABLES ARE SET AT THEIR 1978 VALUES FOR 1979 TO 1981. ;
LOAD SF2 ;
.01 .01 .01 .01 ;
LOAD SF3 ;
.038 .038 .038 .038 ;
LOAD SF4 ;
.007 .007 .007 .007 ;
LOAD SF5 ;
```

```
.017 .017 .017 .017 ;
LOAD SF6 ;
.152 .152 .152 .152 ;
LOAD SF7 ;
.057 .057 .057 .057 ;
LOAD SL1 ;
.0862 .0862 .0862 .0862 ;
LOAD SL2 ;
.0062 .0062 .0062 .0062 ;
LOAD SL6 ;
.2372 .2372 .2372 .2372 ;
LOAD ST1 ;
.1040 .1040 .1040 .1040 ;
LOAD ST2 ;
.0478 .0478 .0478 .0478 ;
LOAD ST3 ;
.026 .026 .026 .026 ;
LOAD ST4 ;
.052 .052 .052 .052 ;
LOAD ST5 ;
.0666 .0666 .0666 .0666 ;
LOAD ST6 ;
.3526 .3526 .3526 .3526 ;
LOAD ST7 ;
0 0 0 0 ;
LOAD TIME ;
12 13 14 15 ;
LOAD TIMYK ;
117.8 113.2 159.3 53.2 ;
LOAD VPLYK ; ? ESTIMATED 1979 TO 1981 ;
31 31 31 31 ;
LOAD XRTE ;
.8432 .8561 .8554 .8342 ;
LOAD YD;
154975 173810 195338 225989 ;
END ;
```

POOR

QUALITY

ORIGINAL